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ELEMENTARY ARITHMETIC

J. W. NICHOLSON

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ELEMENTARY ARITHMETIC

BY

J. W. NICHOLSON, A.M., LL.D.
PROFESSOR OF MATHEMATICS
LOUISIANA STATE UNIVERSITY

AMERICAN BOOK COMPANY
NEW YORK CINCINNATI CHICAGO
1916

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ELEM. ARITH.

E-P 8

INTRODUCTION

This introduction is intended (1) to take the place of a preface, and (2) to offer some helpful suggestions to the teachers who may use this book.

(*a*) **Number facts** and **number applications** are the things of which arithmetic treats.

Number facts are not only such facts as (1) $4 + 3 = 7$, (2) $6 \times 5 = 30$, and (3) $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$, but they are also the steps and laws by which the results of combining numbers are determined.

Number applications are the applications of number facts to concrete quantities or the concerns of life. The following are applications, respectively, of the above facts:

(1) If there are 4 birds in one cage and 3 birds in another, there are 7 birds in both cages.

(2) If the price of oranges is 5 cents each, 6 oranges will cost 30 cents.

(3) $\frac{1}{2}$ of a dozen eggs and $\frac{1}{3}$ of a dozen eggs are $\frac{5}{6}$ of a dozen eggs.

(*b*) **Practically**, the valuable part of arithmetic is to be sought in the applications. Without these the number facts are practically worthless. But without the number facts there can be no number applications. Figuratively, the facts are the tools with which the applications are made. A man may understand the theory of constructing houses, but his ability to do the work himself depends on his skill in the use of the hammer, the saw, and the plane. Similarly, proficiency in the applications of numbers requires a knowledge of number facts and the ability to combine numbers accurately and rapidly.

(*c*) **Educationally**, both the facts and applications of numbers are valuable in so far as they develop in the pupils the powers of observation, comparison, and generalization, as well as independent, persistent, and consecutive thinking. This consummation depends largely on the manner in which the facts and applications are presented. In the present book, and also in the "Grammar School Arithmetic" of this two-book series, an effort has been made to introduce suitable matter in such a manner as to secure the best results, educationally and practically. The main features of the book are based on, and are the outgrowth of, the following considerations.

(*d*) **Induction and drilling.** The primary number facts should be presented and taught in connection with concrete quantities. The objects selected should be those with which the pupils are most familiar, especially those which appeal to them most strongly. After the meanings of the terms, the signs, the operations, and the fundamental concepts have been thoroughly grasped by the pupils they should be drilled in the number facts pertaining thereto until they can name or perform the combinations readily and accurately. Teachers should not become so engrossed with the so-called "informational features" of the work as to lose sight of the "mechanical processes," nor *vice versa.* It is a sad reflection on any school that the pupils thereof who have finished arithmetic are unable to add, subtract, multiply, and divide with facility, and to make a practical application of any abstract work they have performed. It is advisable to begin each recitation with a short, spirited review of number facts, especially those in which the pupils are least proficient; and it is well to require the pupil to make applications of some, if not all, the facts referred to.

(*e*) **Unity of the whole.** Pupils should be led, as soon as possible, to see the relation of the four fundamental operations. Because (1) they will then have a smaller number of independent facts to learn, (2) they will learn the facts more readily and remember them longer, and (3) they will get a broader and more fruitful knowledge of the subject.

The child who knows that $3 + 2 = 5$ has no independent fact to learn in finding $5 - 3$, when it is presented thus, $3 + ? = 5$. Therefore addition and subtraction, and multiplication and division should be taught together, at least until the relations of the operations are learned. Furthermore, the pupil should be thoroughly taught how to multiply by addition and how to divide by subtraction. Thus the child learns the *oneness* of operations. But, in addition to this, he should come to see that arithmetic, as a whole, is pervaded by common principles and connected by common laws. The next paragraph will explain to some extent how this book attempts to compass this.

(*f*) **Building normally and logically.** The teacher and pupil should get the idea that learning arithmetic is a process of building,—beginning with the simplest facts and applications as a base, and gradually building on these by the expansion of numbers and the introduction of new ideas. This book is divided into parts which form and emphasize important steps in the process of this construction. A glance at the Table of Contents will show the progressive and logical order of these steps. Part I treats of *ones*, from 1 to 10, introducing the ideas of addition, subtraction, multiplication, division, fractions, and measurements; and each succeeding part is largely a review and extension of what has gone before. Thus it will be seen that the treatment is continuous, being both spiral and topical, avoiding the extremes of each method and securing the advantages of both.

It may be that the pupils have already had the substance of Part I in oral instruction; but it is advisable for them to go over it again, at least hurriedly. Thus they will crystallize what they know by reviewing it in *writing*, and also bring themselves into touch with the system which pervades the book.

(*g*) The **higher applications**, both in this and the "Grammar School Arithmetic," relate mostly to what concerns the business man and the farmer. In the higher book special attention is given to cotton, corn, rice, hay, sugar cane, dairying, etc.; while in the present book an effort is made to interest and instruct pupils in farm and garden concerns, and in the kinds of birds and insects that are beneficial and hurtful. While this material affords useful and interesting practice in the manipulation and application of numbers, it meets, at the same time, the modern demand for the teaching of agriculture and the industries in the public schools. Evidently arithmetic may treat of things pertaining to the industries as well as of things relating to commercial institutions. Therefore, information about birds, insects, poultry, hogs, cotton, corn, dairying, cultivating and harvesting, farm drainage, the reckoning of farm crops, etc., is as appropriate in arithmetic as information about banks, bonds, stocks, etc. The introduction of "farm arithmetic" into this book instead of into the higher one is designed to meet the wants of that vast army of children who leave school before they reach the grammar grades. As many of them spend their lives on farms, they have no occasion to apply the rules of stocks and bonds and kindred subjects. The problems relating to farming, etc., have been carefully graded for fourth or fifth grade pupils.

(*h*) **Oral and written work** in this book are distinguished by the kinds of type used in the *numbers* of the questions and problems, — *script* being used for oral work and *Roman* for written work. However, the teacher need not always conform to the work as thus indicated. The individual needs of the pupils should determine when the work should be oral and when written, and of such needs the teacher is the best judge. As a rule, *induction* should be oral and *deduction* written.

(*i*) **Division as to grades.** No attempt is made to arrange the matter by grades, because schools cannot all be graded alike. However, the parts into which the book is divided make it easy for the educational authorities to fix the work of grades so as to meet local conditions.

In conclusion, the author would express his obligations for valuable data to his colleagues E. A. Bessy, Ph.D., Professor of Botany, W. H. Gates, B.A., Acting Professor of Zoölogy and Entomology, and Wilmon Newell, M.S., Entomologist, Crop Pest Commission. For valuable suggestions relating to matter and method throughout the book, the author returns his sincere thanks to J. E. Keeny, President of the Louisiana Industrial Institute.

The author is especially indebted to Professor T. P. Scott, Principal of the Brookhaven High School, Mississippi. Few teachers have had a more successful career in teaching the grades than Professor Scott. He has always been an earnest advocate of the movement to teach the elements of agriculture in the public schools, and has given much time and study to the conditions essential to success. He has critically read this book, both in manuscript and in proof; and Part VIII, comprising "farm arithmetic," was prepared almost entirely by him.

J. W. NICHOLSON

BATON ROUGE, LOUISIANA.

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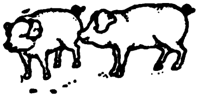
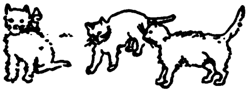
ELEMENTARY ARITHMETIC *

I. ONES — FROM 1 TO 10



1. How many pigs are there in this picture?

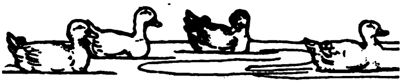
Make the figure for two.



2. Count the kittens.

How many more kittens are there than pigs?

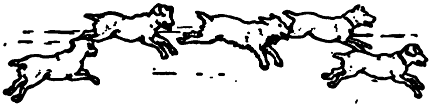
Make the figure for three.



3. Count the ducks.

How many more ducks are there than kittens?

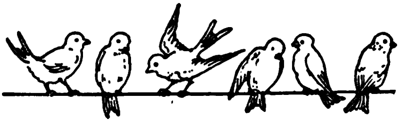
Make the figure for four.



4. Count the dogs.

How many more dogs are there than ducks?

Make the figure for five.



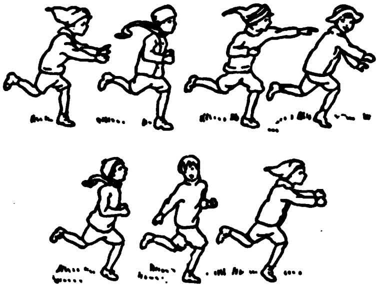
5. Count the birds.

How many more birds are there than dogs?

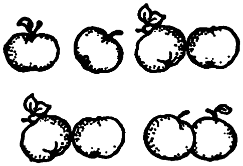
Make the figure for six.

---

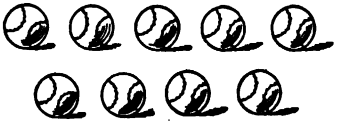
* Teachers who use this book should read the introduction carefully.



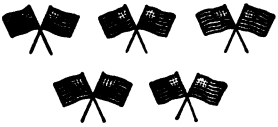
6. Count the boys.
How many more boys are there than birds?
Make the figure for seven.



7. Count the apples.
How many more apples are there than boys?
Make the figure for eight.



8. Count the balls.
How many more balls are there than apples?
Make the figure for nine.



9. Count the flags.
How many more flags are there than balls?
Make the figures for ten.

10. Write the first ten numbers in words and figures.
Names: *one*, *two*, *three*, *four*, *five*, *six*, *seven*, *eight*, *nine*, *ten*.
Figures: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
The figure 0 stands for *none*. It is called **zero** or **naught.**

11. Begin at 1 and count forward to 10.

12. Begin at 10 and count backward to 1.

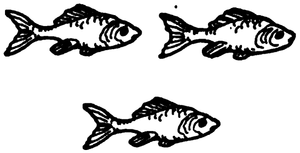
13. Now count forward, then backward, rapidly.

ADDITION AND SUBTRACTION

1. Count the fish.

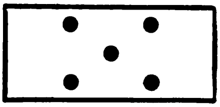
2. If there were one more, how many would there be?

3. If there were one less, how many would there be?



4. How many are 3 and 1? 3 less 1?

5. Count the dots on this card.

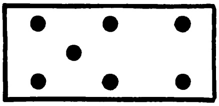


6. If there were one more dot, how many dots would there be?

7. If there were one less, how many dots would there be?

8. How many are 5 and 1? 5 less 1?

9. How many dots are there on this card?

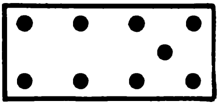


10. If there were one more, how many would there be?

11. If there were one less, how many would there be?

12. How many are 7 and 1? 7 less 1?

13. How many dots are there on this card?



14. If there were one more, how many would there be?

15. If there were one less, how many would there be?

16. How many are 9 and 1? 9 less 1?

17. How many are 2 and 1? 2 less 1?

18. How many are 4 and 1? 4 less 1?

19. How many are 6 and 1? 6 less 1?

20. How many are 8 and 1? 8 less 1?

1. How many are 2 and 2? ○ ○ ○ ○

2. How many are 4 less 2? ○ ○ ⊘ ⊘

3. How many are 3 and 2? ○ ○ ○ ○ ○

4. How many are 5 less 2? ○ ○ ○ ⊘ ⊘

5. We **add** 3 and 2 when we say 3 and 2 are 5, or 3 plus 2 equals 5. Five is the **sum** of 3 and 2.

6. The **sign** for *and* or *plus* is +.

7. The **sign** for *are* or *equals* is =.

Thus, 3 + 2 = 5 means 3 and 2 are 5.

8. We **subtract** 2 from 5 when we say 5 less 2 are 3, or 5 minus 2 equals 3. Three is the **difference** between 5 and 2.

9. The **sign** for *less* or *minus* is −.

Thus, 5 − 2 = 3 means 5 less 2 are 3.

Find the following sums and differences by the given marks:

10. 4 + 2 3 + 3 | | | | | |

11. 6 − 2 6 − 3 6 − 4

12. 5 + 2 4 + 3 | | | | | | |

13. 7 − 2 7 − 3 7 − 4 7 − 5

14. 6 + 2 5 + 3 4 + 4 | | | | | | | |

15. 8 − 2 8 − 3 8 − 4 8 − 5 8 − 6

16. 7 + 2 6 + 3 5 + 4 | | | | | | | | |

17. 9 − 2 9 − 3 9 − 4 9 − 5 9 − 6 9 − 7

18. 8 + 2 7 + 3 6 + 4 5 + 5 | | | | | | | | | |

19. 10 − 2 10 − 3 10 − 4 10 − 5 10 − 6 10 − 7

Study these until the sums can be called quickly:

1 and 1	2 + 8	3 + 3	2 + 1	7 + 2	3 plus 0
0 and 9	3 + 1	2 + 6	4 + 5	1 + 0	6 plus 3
7 and 1	5 + 0	3 + 2	6 + 3	8 + 1	2 plus 2
4 and 3	1 + 4	5 + 1	4 + 4	2 + 5	1 plus 6
3 and 7	9 + 1	3 + 5	6 + 4	7 + 0	5 plus 5

Study these until the differences can be called quickly:

4 less 2	7 − 3	9 − 4	10 − 1	5 − 3	8 minus 6
9 less 8	8 − 4	7 − 2	10 − 5	7 − 4	6 minus 2
3 less 2	8 − 7	9 − 3	10 − 8	8 − 5	10 minus 3
9 less 5	6 − 4	5 − 2	10 − 4	9 − 2	8 minus 1
8 less 2	4 − 3	9 − 1	10 − 7	5 − 1	7 minus 7
7 less 6	9 − 6	8 − 3	10 − 2	9 − 7	10 minus 9
6 less 1	5 − 4	6 − 5	10 − 6	7 − 5	6 minus 3

Name the missing sum or difference:

2	3	6	4	5	7	5	3
+7	+4	+2	+6	+4	+3	+2	+6
9	8	6	7	5	9	7	8
−4	−6	−4	−3	−1	−5	−5	−4
10	9	8	10	6	8	10	9
−6	−6	−5	−4	−3	−3	−7	−2
5	3	6	7	4	2	8	4
+?	+?	+?	+?	+?	+?	+?	+?
9	7	8	10	10	9	10	8

1. How many birds are 1 bird and 2 birds?

2. George has 4 marbles in one pocket and 3 in the other. How many marbles has he in both pockets?

3. There are 4 girls on one bench and 2 on another. How many girls are there on both benches?

4. Ruth picked 5 pinks and Belle picked 3. How many more did Ruth pick than Belle?

5. Frank jumped 8 feet and Walter 5 feet. How much did Frank beat Walter?

6. Lucy planted 7 flowers, but 2 of them died. How many of them lived?

7. Three pears and six pears are how many pears?

8. Ella paid 5 cents for an orange and 2 cents for a plum. How much did she spend?

9. Rosa is 10 years old and Emma is 7. How much older is Rosa than Emma?

10. How many are 9 birds less 4 birds? $8 - 6 = ?$

11. How many roses are 4 roses and 5 roses?

12. How many are 10 pins less 8 pins? $7 - 4 = ?$

13. Alice had 6 dresses and her aunt gave her 2 more. How many dresses did she then have?

14. How many more letters are there in the name *Washington* than in *Davis?* in *Jefferson* than in *Lincoln?*

15. Thomas has 5 fish on his string and George has 4. How many fish have both?

16. Lily bought 3 sticks of candy and Anna 3 sticks. How many sticks did both buy?

17. My pencil cost 8 cents and yours 4 cents. How much more did mine cost than yours?

18. Oscar had 8 oranges and ate 3 of them. How many had he left?

19. Maud lives 7 miles from town and Lulu 3 miles farther. How far does Lulu live from town?

20. How many are 6 pies less 2 pies? 8 – 7 = ?

21. Clara found 6 eggs and Hattie found 4. How many eggs did both together find?

22. Four from 10 leaves how many? 3 from 7?

23. Mary has 8 books in one sack and 2 in another. How many books has she?

24. Agnes has 7 flowers in a vase and 2 in her hand. How many flowers has she?

25. Willie is 10 years old and Eddie is 2 years younger than Willie. How old is Eddie?

26. A boy had 9 miles to go. After going 3 miles, how much farther had he to go?

27. How many are 5 books less 2 books? 6 – 4 = ?

28. John has 4 marbles. How many would he have if he had 4 more?

29. I had 10 cents and gave 6 cents for a pound of sugar. How much had I left?

30. What number is 5 less than 7? 3 less than 10?

31. What number is 9 less than 10? 5 less than 9?

32. Lucy gave 5 cents for a pencil and 5 cents for a bottle of ink. How much did she spend?

33. There are 6 pigs in a pen. If 3 pigs are taken out, how many will be left?

MULTIPLICATION AND DIVISION

1. Count these apples.
2. Count them by 2's.
3. How many are 3 times 2?
4. How many 2's are there in 6?
5. Six contains 2 how many times?
6. Count these marks: |||||||||.
7. Count them by 3's. ||| ||| |||.
8. How many are 3 times 3?
9. How many 3's are there in 9?
10. Nine contains 3 how many times?
11. We **multiply** 2 by 3 when we say 3 times 2 are 6. Six is the **product** of 2 and 3.
12. The **sign** for *times* is ×.

Thus, $3 \times 2 = 6$ means 3 times 2 are 6.

13. We **divide** 6 by 2 when we say 6 contains 2 three times. Three is the **quotient** of 6 by 2.
14. The **sign** for *contains* or *divided by* is ÷.

Thus, $6 \div 2 = 3$ means 6 contains 2 three times, or 6 divided by 2 equals 3.

Study these until the products can be called quickly:

2 times 2
3 times 0
2 times 5
3×1
1×5
8×1
1×4
6×1
4×1
2×3
3×2
2×0
5×1
2×4
9×1
1 times 8
0 times 7
3 times 3

Study these until the quotients can be called quickly:

$6 \div 2$
$8 \div 2$
$5 \div 1$
$6 \div 3$
$9 \div 3$
$4 \div 1$
$4 \div 2$
$7 \div 1$
$10 \div 5$
$10 \div 2$
$8 \div 1$
$9 \div 9$

The sign $ stands for dollars, and ¢ for cents.

1. I have three cherries in each hand. How many have I in both hands?

2. Bob gave 2 roses to Ella, 2 to Mary, and 2 to Susan. How many did he give to all?

3. Ella paid 10 ¢ for some 2-cent stamps. How many stamps did she buy?

4. James has 4 miles to walk. How many hours will it take him if he goes 2 miles an hour?

5. A man bought 2 cords of wood, and gave $4 for each cord. How much did he spend?

6. If 5 boys can sit on a bench, how many boys can sit on 2 benches?

7. Nine boys are in the wagons. If 3 boys are in each wagon, how many wagons are there?

8. There are 6 pears in a basket. How many girls can have 2 pears apiece?

9. I wish to give Nora and Eva 2 roses apiece. How many roses will it take?

10. How many pencils can you buy for 6 ¢, if each pencil costs 3 ¢?

11. If George steps 2 feet at a time, how many steps must he make to go 8 feet?

12. Martha spent 10 ¢ for pencils, and the price per pencil was 5 ¢. How many pencils did she buy?

13. If silk is worth $1 per yard, how many yards can Annie buy for $7?

14. At $4 a pair, how many pairs of shoes can be bought for $8?

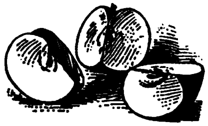
EQUAL PARTS

1. This apple is cut into how many equal parts? What is one part called?

2. One half is written $\frac{1}{2}$.

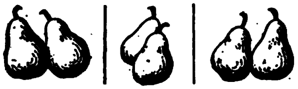
⊘ ⊘ | ⊘ ⊘ ● ● ● | ● ● ●

3. How much is $\frac{1}{2}$ of 4 balls? $\frac{1}{2}$ of 6 dots?



4. This apple is cut into how many equal parts? What is one part called?

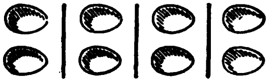
5. One third is written $\frac{1}{3}$.



● ● ● | ● ● ● | ● ● ●

6. How much is $\frac{1}{3}$ of 6 pears? $\frac{1}{3}$ of 9 dots?

7. This apple is cut into how many equal parts? What is one part called?



8. One fourth is written $\frac{1}{4}$.

9. How much is $\frac{1}{4}$ of 8 eggs?

10. How much is $\frac{1}{4}$ of 8 dollars?

11. How much is $\frac{1}{4}$ of 8 inches?

12. When we take $\frac{1}{3}$ of 9 we divide 9 by 3. That is, $\frac{1}{3}$ of 9 is the same as 9 ÷ 3.

13. How much is $\frac{1}{3}$ of 9 tables? 9 ÷ 3 = ?

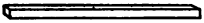
14. How much is $\frac{1}{2}$ of \$6? \$6 ÷ 2 = ?

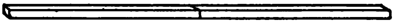
15. How much is $\frac{1}{2}$ of 10 apples? 10 apples ÷ 2 = ?

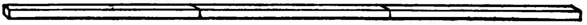
16. How much is $\frac{1}{3}$ of 6¢? 6¢ ÷ 3 = ?

17. How much is $\frac{1}{4}$ of 8¢? 8¢ ÷ 4 = ?

LENGTHS

A  *One-inch splint.*

B  *Two-inch splint.*

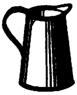
C  *Three-inch splint.*

1. Which is the longer, *A* or *B*? *B* or *C*?
2. Which is the shorter, *A* or *B*? *B* or *C*?
3. What is the length of *A*? of *B*? of *C*?
4. What is the united length of *A* and *B*?
5. What is the length of *A* and *C* together?
6. What is the length of *B* and *C* together?
7. How much is 2 inches + 3 inches?
8. What is the length of *A*, *B*, and *C* together?
9. How much longer is *B* than *A*? *C* than *A*?
10. How much longer are *A* and *C* together than *B*?
11. How many are 3 + 1 − 2?
12. How much longer are *B* and *C* together than *A*?
13. How many are 3 + 2 − 1?
14. *B* is how many times as long as *A*?
15. *A* is equal to what part of *B*? to what part of *C*?
16. *C* is how many times as long as *A*?
17. How many times does *B* contain *A*?
18. How many times does *C* contain *A*?

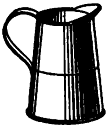
How many inches (in.) are:

19. 3 in. + 2 in.? 5 in. + 3 in.? 8 in. + 2 in.? 6 in. + 3 in.?
20. 7 in. − 3 in.? 9 in. − 4 in.? 6 in. − 3 in.? 10 in. − 2 in.?
21. 2 × 3 in.? 3 × 3 in.? 4 × 2 in.? 5 × 2 in.?
22. $\frac{1}{2}$ of 6 in.? $\frac{1}{3}$ of 9 in.? $\frac{1}{4}$ of 8 in.? $\frac{1}{2}$ of 10 in.?

LIQUID MEASURES



Pint



Quart

1 QT.
1 QT.
1 QT.
1 QT.

Gallon

Note. If these measures are available, it is best for the teacher to let the pupil find for himself, by using water, how many times each measure contains the next smaller.

1. Is water a liquid? Name two other kinds of liquids.
2. Why are the above vessels called liquid measures?
3. How many pints of water will fill a quart measure?
4. What part of a quart is a pint?
5. How many quarts of milk will fill a gallon measure?
6. What part of a gallon is a quart?
7. How many pints of vinegar will fill a gallon measure?
8. What part of a gallon is a pint?

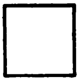
Pt. stands for "pint" or "pints," qt. for "quart" or "quarts," and gal. for "gallon" or "gallons."

Complete the following, and write each in figures, signs, and abbreviations:

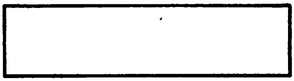
9. — pints are a quart. (2 pt. = 1 qt.)
10. — quarts are a gallon; — pints are a gallon.
11. A quart is — times a pint; 1 gallon is — times 1 quart.
12. A pint is -- of a quart; 1 gallon is — times 1 pint.
13. A quart is — of a gallon; a pint is — of a gallon.

Two pints equal one quart (2 pt. = 1 qt.).
Four quarts equal one gallon (4 qt. = 1 gal.).

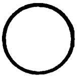
GEOMETRIC FIGURES



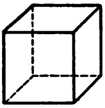
Square



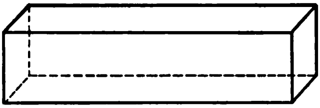
Oblong



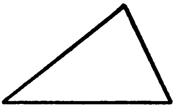
Circle



Cube



Cuboid



Triangle

1. How many sides has a square? Are they all equal? How many corners has it? Are they all square corners?

2. Answer the same four questions about an oblong.

3. How many faces has a cube? Each face is a ——.

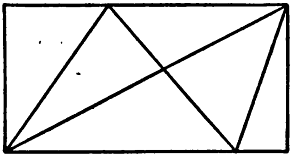
4. How many ends has a cuboid? Each end is a ——.

5. How many sides has a cuboid? Each side is a ——.

6. How many sides has a triangle?

7. Is the boundary of a circle a straight line or a curved line?

8. Point out ten different triangles in this oblong.



Pupils should be thoroughly taught the names of the above figures, and also how to draw them. A circle may be drawn by marking around any round object, as a dime or the top of a round can.

Add upward, and then add downward:

1.	*2.*	*3.*	*4.*	*5.*	*6.*
3	5	4	1	7	4
2	1	3	2	0	3
2	2	2	6	3	3

7.	*8.*	*9.*	*10.*	*11.*	*12.*
3	5	2	2	2	3
3	2	4	7	2	3
1	3	4	1	4	3

13. How many are $4 + 3 - 5$?

Ans. **4 and 3 are 7, and 7 less 5 are 2.**

Find the following:

14. $3 + 6 - 4$ *15.* $2 + 8 - 3$ *16.* $3 + 5 - 4$

17. $2 + 5 - 3$ *18.* $7 + 3 - 6$ *19.* $4 + 6 - 3$

20. $9 - 2 + 3$ *21.* $8 - 5 + 4$ *22.* $8 - 6 + 5$

23. $7 - 4 + 5$ *24.* $9 - 7 + 8$ *25.* $7 - 2 + 4$

Find the following by addition and by multiplication:

26. $2 + 2$ *27.* $2 + 2 + 2$ *28.* $2 + 2 + 2 + 2$

29. $3 + 3$ *30.* $3 + 3 + 3$ *31.* $4 + 4$

32. $5 + 5$ *33.* $2 + 2 + 2 + 2 + 2$

34. How many 2's are there in 4? in 6? in 8?

35. How many 3's are there in 3? in 6? in 9?

36. How many 4's are there in 4? in 8?

37. How many 2's are there in $2 + 4$? in $4 + 6$?

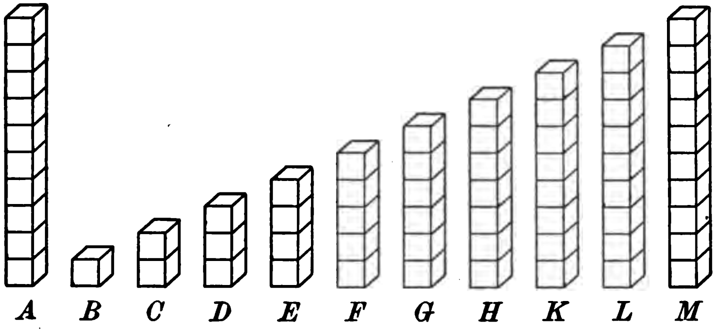
38. How much will two 2-cent stamps cost?

39. How much will three 2-cent stamps cost?

40. How many pints are there in 2 quarts? in $\frac{1}{2}$ a quart?

41. How many pints are there in $\frac{1}{4}$ of a gallon?

II. TEN AND ONES—FROM 10 TO 20



1. How many cubes are there in ***B***? in ***C***? in ***D***? in ***E***? ***F***? ***G***? ***H***? ***K***? ***L***? ***M***? ***A***?

How many cubes are there:

2. In *A* and ***B***? Write the number in figures.

3. In *A* and *C*? Write the number in figures.

4. In *A* and ***D***? Write the number in figures.

5. In *A* and ***E***? Write the number in figures.

6. In *A* and ***F***? Write the number in figures.

7. In *A* and ***G***? Write the number in figures.

8. In *A* and ***H***? Write the number in figures.

9. In *A* and ***K***? Write the number in figures.

10. In *A* and ***L***? Write the number in figures.

11. In *A* and ***M***? Write the number in figures.

12. Begin with ten and count to twenty.

Ans. **Ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty.**

PRELIMINARY REVIEW.

1. When 3 and 2 are added, what number do they form? What number do 4 and 1 form?

2. What number do 1 and 5 form? 2 and 4? 3 and 3?

3. Name all the pairs of numbers which form 2; 3; 4; 5; 6; 7; 8; 9; 10.

4. How many, then, are $6 + 3$? $5 + 2$? $7 + 3$? $3 + 5$?

5. How many are 4 less 1? 5 less 2? 6 less 3? 7 less 4? 8 less 5? 9 less 6? 10 less 7?

6. Name, in like manner, all the pairs of numbers up to 10 whose difference is 1; 2; 3; 4; 5; 6; 7; 8; 9.

7. How many, then, are $9 - 4$? $8 - 6$? $10 - 4$? $7 - 3$?

8. Find $2 + 2 + 2 + 2$ in two ways. The longer way is by what operation? The shorter way is by what operation?

9. Find 3×3 by addition. Find it by multiplication.

10. How many are 2×2? 2×5? 3×2? 2×3? 3×3? 4×2?

11. How many 2's are there in 6? 3's in 6? 4's in 8?

12. How many times is 2 contained in 8? in $2 + 4$?

13. How many times is 3 contained in 9? in $9 - 3$?

14. Find $8 \div 2$; $6 \div 3$; $\frac{1}{2}$ of 6; $\frac{1}{3}$ of 9; $\frac{1}{4}$ of 8.

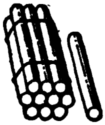
15. Make an application of $3 + 2 = 5$.

Ans. **If Ella has 3 roses in one hand and 2 roses in the other hand, she has 5 roses in both hands.**

Make three applications of each of the following:

16. $3 + 4 = 7$. *17.* $10 - 4 = 6$. *18.* $3 \times 2 = 6$.
19. $9 \div 3 = 3$. *20.* $7 + 2 = 9$. *21.* $8 - 3 = 5$.
22. $2 \times 4 = 8$. *23.* $\frac{1}{2}$ of $6 = 3$.

Eleven
is 1 Ten and 1 One.



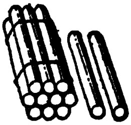
$$11 = \begin{array}{l} 9 \text{ and } 2 \\ 8 \text{ and } 3 \\ 7 \text{ and } 4 \\ 6 \text{ and } 5 \end{array}$$

1. How many are 10 and 1? 9 and 2? 8 and 3.
2. Name the pairs of numbers less than 10 which form 11.
3. Name the missing number or difference:

$$\begin{array}{rrrrrrrr} 2 & ? & 7 & ? & 6 & ? & 9 & ? \\ +\,? & +\,5 & +\,? & +\,8 & +\,? & +\,4 & +\,? & +\,3 \\ \hline 11 & 11 & 11 & 11 & 11 & 11 & 11 & 11 \end{array}$$

$$\begin{array}{rrrrrrrr} 11 & 11 & 11 & 11 & 11 & 11 & 11 & 11 \\ -\,? & -\,8 & -\,? & -\,2 & -\,? & -\,9 & -\,? & -\,3 \\ \hline 6 & ? & 5 & ? & 7 & ? & 4 & ? \end{array}$$

Twelve
is 1 Ten and 2 Ones.



$$12 = \begin{array}{l} 9 \text{ and } 3 \\ 8 \text{ and } 4 \\ 7 \text{ and } 5 \\ 6 \text{ and } 6 \end{array}$$

4. How many are 10 and 2? 9 and 3? 8 and 4?
5. Name the pairs of numbers less than 10 which form 12.
6. Name the missing number or difference:

$$\begin{array}{rrrrrrr} ? & 5 & ? & 6 & ? & 8 & ? \\ +\,7 & +\,? & +\,4 & +\,? & +\,8 & +\,? & +\,3 \\ \hline 12 & 12 & 12 & 12 & 12 & 12 & 12 \end{array}$$

$$\begin{array}{rrrrrrr} 12 & 12 & 12 & 12 & 12 & 12 & 12 \\ -\,4 & -\,? & -\,8 & -\,? & -\,7 & -\,? & -\,3 \\ \hline ? & 6 & ? & 9 & ? & 5 & ? \end{array}$$

Add upward, then downward:

1.	1	2	3	2	4	3	5	4	4	5	3	2
	9	8	7	7	6	6	5	5	4	3	0	9
	1	1	1	2	1	2	1	2	3	3	8	0
2.	2	3	2	1	4	3	5	4	3	5	4	4
	9	8	8	8	7	7	6	6	6	5	3	4
	1	1	2	3	1	2	1	2	3	2	5	4

Subtract rapidly:

3.	11	11	11	11	11	11	11	11
	5	9	3	7	2	6	8	4
4.	12	12	12	12	12	12	12	12
	9	5	8	3	7	4	1	6

5. There are 8 balls on the ground and 3 balls in the basket. How many balls are there in all?

6. Cora had 5 plums and I gave her 6 more. How many had she then?

7. If a lemon costs 4¢ and an orange 8¢, how much will both cost?

8. Ida has 11 roses and Ella 8. How many more has Ida than Ella?

9. What number is 5 less than 12?

10. Find 9 + 2, and make an application of it.

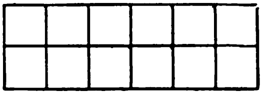
Ans. 9 + 2 = 11. If John has 9 pears and Henry has 2 pears, both together have 11 pears.

11. Find 7 + 5, and make an application of it. Find the following and make an application of each:

12. 6 + 5 *13.* 7 + 4 *14.* 11 − 5 *15.* 11 − 7 *16.* 11 − 3
17. 8 + 4 *18.* 6 + 6 *19.* 12 − 4 *20.* 12 − 9 *21.* 12 − 6

1. Count the squares in this oblong.

2. Count them by twos.



3. How many 2's are there?

4. How many are 6 times 2?

5. How many 2's are there in 12? $12 \div 2 = ?$

6. Count the squares by sixes.

7. How many 6's are there?

8. How many are 2 times 6?

9. How many 6's are there in 12? $12 \div 6 = ?$

10. How many squares are $\frac{1}{2}$ of 12 squares? Point them out, and tell why.

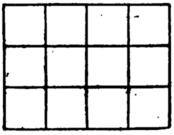
11. How many squares are $\frac{1}{6}$ of 12 squares? Point them out, and tell why.

12. Count the squares in this oblong.

13. Count them by threes.

14. How many 3's are there?

15. How many are 4 times 3?



16. How many 3's are there in 12? $12 \div 3 = ?$

17. Count the squares by fours.

18. How many 4's are there?

19. How many are 3 times 4?

20. How many 4's are there in 12? $12 \div 4 = ?$

21. How many squares are $\frac{1}{3}$ of 12 squares? Point them out, and tell why.

22. How many squares are $\frac{1}{4}$ of 12 squares? Point them out, and tell why.

DOZEN

Twelve things equal one dozen (doz.).

1. George has 9 marbles. How many more does he need to have a dozen?

2. How many are a half dozen?

3. Ella has 11 tulips. How many more than a half dozen has she?

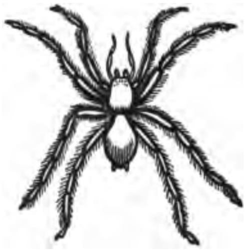
4. How many are a third of a dozen? $\frac{1}{3}$ of 12 = ? |||| |||| ||||

5. How many are a quarter of a dozen? $\frac{1}{4}$ of 12 = ? ||| ||| ||| |||

6. How many are a sixth of a dozen? $\frac{1}{6}$ of 12 = ? || || || || || ||

7. Frank has a half-dozen marbles and Paul has a third of a dozen. How many marbles have they together?

8. Ethel has a quarter of a dozen pinks and Nora has a sixth of a dozen. How many more pinks has Ethel than Nora?

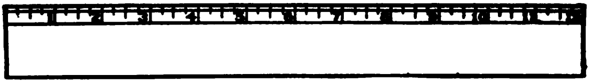


9. How many legs has a spider?

10. How many less than a dozen?

11. How many more than a half dozen?

MEASURING LENGTH



The figure above represents a foot rule, but it is only one fourth the real length. Each space represents one inch. "Foot" or "feet" is denoted by "ft.," and "inch" or "inches" by "in."

Twelve inches equal one foot (12 in. = 1 ft.).

1. Cut from a cardboard a foot rule, and mark the inches on it.

2 With the rule measure the length and width of your book. How many inches long is it? How many inches wide?

3. Measure the length and width of the blackboard. How many feet long and wide is it, and how many inches over?

4. Let the pupil measure any convenient objects in the room.

5. How many inches are there in $\frac{1}{2}$ of a foot? in $\frac{1}{3}$ of a foot? in $\frac{1}{4}$ of a foot? in $\frac{1}{6}$ of a foot?

Three feet equal one yard (3 ft. = 1 yd.).

6. How many feet are there in 2 yd.? in 3 yd.?

7. How many feet are there in $\frac{1}{3}$ of a yard?

8. With your foot rule lay off a yard on a straight stick. You have now a yardstick.

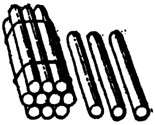
9. With your yardstick measure the length of the schoolroom. How many yards long is it, and how many feet and inches over?

10. In the same way measure the width of the room, and state how wide it is in yards, feet, and inches.

THIRTEEN TO EIGHTEEN

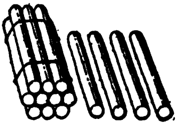
Pupils should learn the formation and parts of the following numbers:

Thirteen
is 1 Ten and 3 Ones.



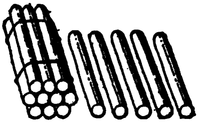
9 and 4
13 = 8 and 5
7 and 6

Fourteen
is 1 Ten and 4 Ones.



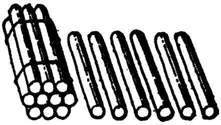
9 and 5
14 = 8 and 6
7 and 7

Fifteen
is 1 Ten and 5 Ones.



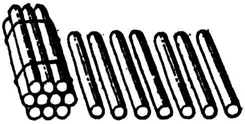
15 = 9 and 6
8 and 7

Sixteen
is 1 Ten and 6 Ones.



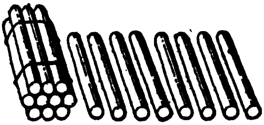
16 = 9 and 7
8 and 8

Seventeen
is 1 Ten and 7 Ones.



17 = 9 and 8

Eighteen
is 1 Ten and 8 Ones.



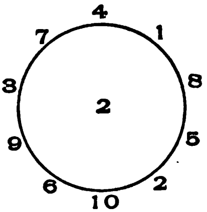
18 = 9 and 9

ADDITION

Add quickly:

5	6	2	7	2	6	1	4	5	2	2
7	3	7	1	8	5	4	4	5	2	6
3	8	7	7	9	2	8	6	4	3	6
3	5	4	7	6	5	9	1	5	8	7
6	1	4	3	4	2	3	1	3	9	7
6	9	3	9	8	9	7	2	5	5	8
9	6	4	8	6	4	8	7	3	5	1
9	8	2	1	4	9	8	9	2	1	3

It is important that pupils should be drilled in this exercise until they can name all the indicated sums instantly.



1. Draw a circle, and write the numbers from 1 to 10 around it, as in the figure. Write 2 at the center.

2. Add the 2 to each of the other numbers, taken in the order written.

3. Erase the 2 at the center, write 3 in its place, and add as before.

4. Put 4 at the center and add; then 5; 6; 7; 8; 9; 10.

This device should be drawn on the board and used in class drill daily, until each pupil can call the sums promptly.

The recitations should be brief and spirited. Sometimes the questions should first be answered by the pupils individually, and then by the members of the class in concert.

1. Alice had 6 apples and her aunt gave her 5 more. How many had she then?

2. Gordon has 9 pears and Frank 5. How many have they together?

3. Thomas walked 6 miles and George 7. How many miles did both walk?

4. Ruth bought 9 sticks of candy and Anna 6. How many sticks did both buy?

5. How many books are 8 books and 9 books?

6. There are 4 houses on one block and 8 on another. How many houses are there on both blocks?

7. Maud lives 9 miles from town and Lulu 7 miles farther. How far does Lulu live from town?

8. Eugene spent 7 dimes for a knife and 8 dimes for a hat. How many dimes did he spend?

9. How many girls are 7 girls and 5 girls?

10. Ann had 8 cherries and James gave her 3 more. How many had she then?

11. There are 8 plums on one limb and 8 on another. How many are there on both limbs?

12. Jane had 8 birds and Frank gave her 6 more. How many had she then?

13. John is 9 years old and Ben is 4 years older. How old is Ben?

14. How many plums are 7 plums and 7 plums?

15. How many cakes are 8 cakes and 5 cakes?

16. How many birds are 7 birds and 4 birds?

17. How many forks are 6 forks and 6 forks?

18. How many boxes are 9 boxes and 3 boxes?

Add upward, then downward:

1.	5	2	3	5	6	9	8	2	7
	7	5	6	3	1	3	2	7	3
	1	6	4	5	6	1	3	4	3
2.	5	6	7	2	3	4	4	1	9
	2	3	3	4	3	4	5	5	2
	7	5	4	6	8	6	3	8	3
3.	6	5	9	7	6	2	4	9	3
	5	5	5	5	8	6	3	3	6
	4	5	1	3	1	7	8	3	6
4.	1	2	3	7	4	5	6	2	5
	8	8	8	7	8	6	7	9	7
	7	6	5	2	4	5	3	5	4
5.	7	6	5	4	8	7	5	3	2
	9	9	9	9	8	7	7	6	8
	1	2	3	4	1	3	5	8	7
6.	8	7	6	5	8	7	3	6	4
	9	9	9	9	8	7	8	7	6
	1	2	3	4	2	4	7	5	8
7.	9	6	4	7	8	5	3	8	4
	9	7	8	7	9	6	9	3	9
	1	6	7	5	2	8	7	8	6
8.	9	8	6	8	6	5	7	6	6
	9	4	7	9	8	7	9	6	9
	2	8	7	3	6	8	4	6	5

SUBTRACTION

1. How many boys are needed for a football team?

2. If there are 4 boys in the back, how many are in the line? 11 less 4 are how many?

3. How many are 11 – 5? 11 – 3? 11 – 9?

4. Make 12 marks; rub out 5 of them. How many are left? 12 – 5 = ?

5. How many are 8 and 5? |||||||| |||||

6. How many, then, are 13 – 8? 13 – 5?

7. Because 7 + 6 = 13, 13 – 6 = ? 13 – 7 = ?

8. Because 9 + 4 = 13, 13 – 4 = ? 13 – 9 = ?

9. Because 7 + 7 = 14, 14 – 7 = ?

10. Because 8 + 6 = 14, 14 – 6 = ? 14 – 8 = ?

11. Because 5 + 9 = 14, 14 – 5 = ? 14 – 9 = ?

12. Complete 9 + ? = 15, then 15 – 9 = ?

13. Complete 6 + ? = 15; then 15 – 6 = ?

14. Complete 8 + ? = 15; then 15 – 8 = ?

15. Complete 7 + ? = 15; then 15 – 7 = ?

16. Complete 8 + ? = 16; then 16 – 8 = ?

17. Complete 9 + ? = 16; then 16 – 9 = ?

18. Complete 8 + ? = 17; then 17 – 8 = ?

Note. As the pupil already knows the sums of the primary combinations, he will more readily learn subtraction as he comes to see it through the operation of addition.

Thus, $5 + ? = 9$ $9 - 5 = ?$ $3 + ? = 8$ $8 - 3 = ?$

For drill.

Read across the page from left to right.

$8 + 7 = ?$ $7 + 8 = ?$ $15 - 8 = ?$ $15 - 7 = ?$
$9 + 4 = ?$ $4 + 9 = ?$ $13 - 9 = ?$ $13 - 4 = ?$
$5 + 6 = ?$ $6 + 5 = ?$ $11 - 6 = ?$ $11 - 5 = ?$
$9 + 7 = ?$ $7 + 9 = ?$ $16 - 9 = ?$ $16 - 7 = ?$
$8 + 6 = ?$ $6 + 8 = ?$ $14 - 8 = ?$ $14 - 6 = ?$
$9 + 5 = ?$ $5 + 9 = ?$ $14 - 9 = ?$ $14 - 5 = ?$
$6 + 6 = ?$ $7 + 7 = ?$ $12 - 6 = ?$ $14 - 7 = ?$
$8 + 8 = ?$ $9 + 9 = ?$ $16 - 8 = ?$ $18 - 9 = ?$

Answer the following thus: 6 and 4 are 10, 10 less 6 are 4; etc.

$6 + ? = 10$ $9 + ? = 15$ $8 + ? = 14$ $9 + ? = 16$
$8 + ? = 16$ $7 + ? = 14$ $9 + ? = 18$ $4 + ? = 11$
$5 + ? = 10$ $9 + ? = 17$ $6 + ? = 11$ $9 + ? = 12$
$8 + ? = 10$ $5 + ? = 12$ $7 + ? = 15$ $8 + ? = 13$
$6 + ? = 12$ $7 + ? = 10$ $4 + ? = 12$ $6 + ? = 13$
$9 + ? = 13$ $2 + ? = 11$ $9 + ? = 14$ $3 + ? = 11$
$6 + ? = 14$ $7 + ? = 16$ $7 + ? = 11$ $6 + ? = 15$

$$\begin{array}{r}2\\+\,?\\\hline 10\end{array}\quad\begin{array}{r}7\\+\,?\\\hline 12\end{array}\quad\begin{array}{r}8\\+\,?\\\hline 15\end{array}\quad\begin{array}{r}5\\+\,?\\\hline 13\end{array}\quad\begin{array}{r}6\\+\,?\\\hline 12\end{array}\quad\begin{array}{r}3\\+\,?\\\hline 10\end{array}\quad\begin{array}{r}8\\+\,?\\\hline 12\end{array}$$

$$\begin{array}{r}13\\-\,7\\\hline ?\end{array}\quad\begin{array}{r}11\\-\,9\\\hline ?\end{array}\quad\begin{array}{r}13\\-\,4\\\hline ?\end{array}\quad\begin{array}{r}14\\-\,9\\\hline ?\end{array}\quad\begin{array}{r}11\\-\,8\\\hline ?\end{array}\quad\begin{array}{r}18\\-\,9\\\hline ?\end{array}\quad\begin{array}{r}14\\-\,8\\\hline ?\end{array}$$

Sight subtraction.

9 less 2
6 less 4
5 less 2
8 less 6
4 less 2
9 less 4
7 less 3
8 less 7
6 less 3
3 less 2
9 less 6
4 less 3
9 less 7
7 less 6

5 – 3
8 – 5
9 – 3
7 – 4
8 – 3
6 – 2
9 – 5
7 – 2
5 – 4
7 – 5
8 – 2
6 – 5
8 – 4
9 – 8

10 – 2
17 – 9
13 – 6
12 – 8
11 – 4
18 – 9
15 – 8
10 – 6
13 – 9
15 – 6
10 – 5
12 – 6
14 – 5
16 – 7

12 – 3
13 – 8
10 – 4
14 – 7
13 – 5
14 – 8
11 – 7
16 – 8
12 – 4
10 – 8
13 – 4
15 – 7
11 – 6
15 – 9

11 less 5
10 less 7
11 less 9
10 less 3
16 less 9
12 less 5
14 less 6
12 less 7
11 less 2
12 less 9
13 less 7
11 less 8
14 less 9
17 less 8

Subtract quickly:

11	12	13	15	11	12	13	16	11	13
2	4	7	7	3	6	9	8	5	4
13	14	15	12	11	14	16	12	11	14
5	9	6	7	8	5	9	3	4	7
12	11	14	16	18	15	12	11	13	17
8	6	8	7	9	8	5	7	6	9
11	15	10	13	10	17	10	14	10	12
9	9	6	8	7	8	9	6	8	9

Pupils should be drilled on the above until they can call all the differences instantly.

1. I walked 14 rods and you walked 9 rods. How much farther did I walk than you?

2. There were 18 panes of glass in one window, but 9 were broken. How many were not broken?

3. If 17 birds are in a tree and 8 fly away, how many will be left?

4. Ida has 13 roses and Ella 6. How many more has Ida than Ella?

5. A farmer had 14 bushels of corn and sold 8 bushels. How many bushels had he left?

6. Walter had 11 oranges, but gave 8 of them to a poor old man. How many did he then have?

7. 12 men went to war and 8 were killed. How many were not killed?

What is the remainder when we take:

8. 9 rugs from 20 rugs? 5 caps from 13 caps?
9. 6 tops from 20 tops? 9 hats from 13 hats?
10. 7 bats from 12 bats? 8 boys from 15 boys?
11. 5 pins from 11 pins? 9 pigs from 12 pigs?

Find:

12. 13 books less 7 books. 14 – 5.
13. 11 pears less 6 pears. 15 – 8.
14. 14 beans less 7 beans. 17 – 9.
15. 16 cages less 7 cages. 13 – 9.
16. 15 boxes less 6 boxes. 11 – 4.
17. 12 mules less 3 mules. 14 – 6.

18. There are 8 boys in the house and 13 in the yard. How many more boys are in the yard than in the house?

ADDITION AND SUBTRACTION

How many are 3 and 4 less 5?

Ans. 3 and 4 are 7; 7 less 5 are 2.

Find:

1. $6 + 4 - 3$ 2 hats + 6 hats − 3 hats
2. $7 + 6 - 5$ 5 caps + 7 caps − 4 caps
3. $4 + 9 - 7$ 7 pegs + 8 pegs − 6 pegs
4. $9 + 8 - 5$ 6 cups + 9 cups − 7 cups
5. $5 + 9 - 6$ 9 rods + 9 rods − 8 rods
6. $6 + 8 - 4$ 7 bins + 7 bins − 5 bins
7. $13 + 4 - 8$ 15 boys + 4 boys − 7 boys
8. $12 + 6 - 5$ 16 bats + 2 bats − 9 bats
9. $14 + 6 - 7$ 17 fans + 3 fans − 8 fans

10. Frank had 9 marbles, found 7 more, and then lost 3. How many had he left?

11. James had $13, earned $5 more, and then spent $7. How much had he then?

12. Charles had 6 plums, gathered 5 more, and then ate 3. How many had he left?

13. Annie had 5 pears, George gave her 8 more, and then she gave her mother 6. How many had she left?

14. William had 11 pigs in one pen and 7 in another, but 5 of them died. How many had he left?

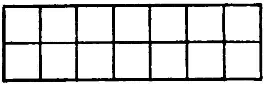
15. A boy earned 7 cents on Thursday, 12 cents on Friday, and spent 8 cents on Saturday. How much did he then have?

16. 10 cups are on the table. How many will be left if Mary puts 6 more on the table and then takes off 7?

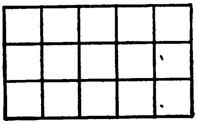
MULTIPLICATION AND DIVISION

1. Find, by this picture, six things, viz.:

$7 \times 2 = ?$ $2 \times 7 = ?$
$14 \div 2 = ?$ $14 \div 7 = ?$
$\frac{1}{2}$ of $14 = ?$ $\frac{1}{7}$ of $14 = ?$

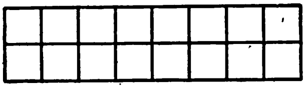


2. In like manner, find six things by this picture:

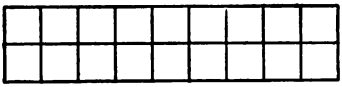


In like manner, find six things by each of the following:

3.

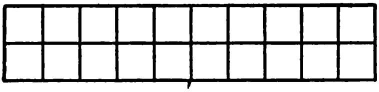


4.



X

5.



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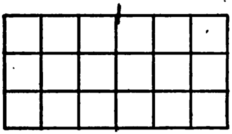
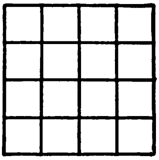


7.



8. Now make a picture by which you can find 4×5, 5×4, $20 \div 5$, $20 \div 4$, $\frac{1}{4}$ of 20, $\frac{1}{5}$ of 20.

9. Make a picture by which you can find 3×6, 6×3, $18 \div 6$, $18 \div 3$, $\frac{1}{3}$ of 18, $\frac{1}{6}$ of 18.

10. Answer quickly:

$3 \times 4 = ?$ $2 \times 8 = ?$ $14 \div 2 = ?$ $20 \div 4 = ?$
$6 \times 3 = ?$ $5 \times 4 = ?$ $18 \div 3 = ?$ $16 \div 4 = ?$

MULTIPLICATION

Multiply quickly:

2	3	4	2	7	5	8	3	4	10
2	3	1	3	2	3	2	4	5	2
5	2	6	4	4	7	1	2	3	2
2	6	3	2	4	1	5	4	2	7
3	4	2	5	2	2	3	6	9	2
5	3	8	4	10	5	6	2	2	9

Find:

1.	2 times 2 cents	2 × 6 fans	2 × $4
2.	3 times 3 dots	5 × 3 cups	2 × $5
3.	4 times 3 beads	2 × 8 pegs	3 × $6
4.	9 times 2 books	4 × 4 eggs	7 × $2
5.	2 times 3 trees	8 × 2 bugs	10 × $2
6.	3 times 4 hours	4 × 2 boys	5 × $4

7. If 8 yards of calico will make one dress, how many yards will it require to make 2 dresses?

8. A slate cost 10 cents and a book 2 times as much. How much did the book cost?

9. Helen found 3 birds' nests with 4 eggs in each. How many eggs were there in all?

10. If peaches sell at 5 cents a dozen, how much will 4 dozen cost?

11. There are 4 pecks in a bushel. How many pecks are there in 4 bushels?

12. If 1 pound of sugar costs 6 cents, how much will 3 pounds cost?

DIVISION

Divide quickly:

$2\overline{)4}$ $3\overline{)9}$ $4\overline{)16}$ $6\overline{)18}$ $7\overline{)14}$ $2\overline{)12}$ $3\overline{)15}$ $2\overline{)16}$

$3\overline{)6}$ $4\overline{)8}$ $2\overline{)18}$ $5\overline{)10}$ $2\overline{)20}$ $3\overline{)18}$ $4\overline{)12}$ $5\overline{)15}$

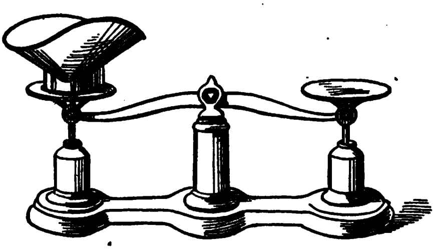
$2\overline{)6}$ $2\overline{)8}$ $8\overline{)16}$ $2\overline{)14}$ $3\overline{)12}$ $2\overline{)10}$ $9\overline{)18}$ $4\overline{)20}$

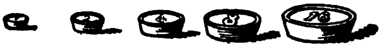
How many 5's are there in 20? 3's in 15? 4's in 16?
How many 3's are there in 9? 5's in 15? 7's in 14?
How many 2's are there in 8? 6's in 18? 8's in 16?

Find:

1. 14 tops ÷ 2 tops $\frac{1}{4}$ of 12 pints $\frac{1}{3}$ of \$6
2. 18 rugs ÷ 3 rugs $\frac{1}{2}$ of 10 birds $\frac{1}{4}$ of \$8
3. 20 bats ÷ 4 bats $\frac{1}{9}$ of 18 books $\frac{1}{2}$ of \$6
4. How many slates can I buy for 15 cents at 5 cents apiece?
5. How many apples can I buy for 12 cents at 3 cents apiece?
6. How many chairs can I buy for 18 dimes at 9 dimes apiece?
7. If 4 hats cost \$16, how much will one hat cost?
8. If 3 tops cost 18 cents, how much will one top cost?
9. If 5 pears cost 20 cents, how much will one pear cost?
10. If 5 yards of calico cost 15 cents, how much will 1 yard cost?
11. If 1 cane costs 7 dimes, how many canes can be bought for 14 dimes?
12. Henry paid 18 cents for 9 tops. How much did he pay for each?

WEIGHTS




1 oz.
2 oz.
¼ lb.
½ lb.
1 lb.
A
B
C
D
E

1. Is butter sold by weight?

2. Name two other articles that are sold by weight.

3. What weight does *B* represent? *C*? *D*?

Sixteen ounces equal one pound (16 oz. = 1 lb.).

4. How many times heavier is *B* than *A*? is *C* than *B*? *D* than *C*? *E* than *D*?

5. What part of *B* is *A*? of *C* is *B*? of *D* is *C*? of *E* is *D*?

6. What part of *C* is *A*? of *E* is *C*?

7. How many 8-ounce weights are equal to the pound weight? how many 4-ounce weights?

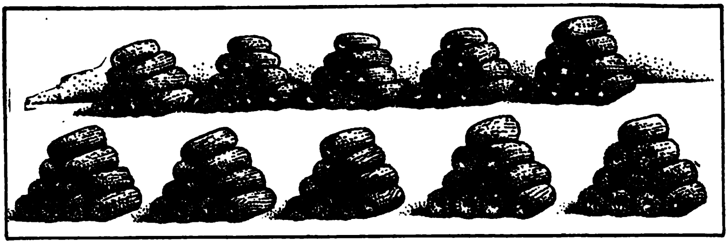
8. A man wishes to buy 7 oz. of shot. Which three weights will the clerk use in weighing it?

9. Which weights will together equal 11 oz.?

10. Mrs. Taylor bought some seed, which balanced the 8-oz. and 4-oz. weights. How much did the seed weigh?

11. In weighing some butter the clerk used weights *A*, *B*, *C*, and *D*. How much did the butter weigh?

III. TENS—FROM 10 TO 100



1. How many ears are there in each pile?

2. How many piles are there?

3. How many ears are there in two piles?

Ans. Two tens or twenty.

4. How many ears are there in three piles? in four piles? five piles? six? seven? eight? nine? ten?

5. What number is 20?

Ans. Two tens or twenty.

6. What number is 30? 40? 50? 60? 70? 80? 90? 100?

7. What figures stand for twenty? for thirty? forty? fifty? sixty? seventy? eighty? ninety? hundred?

8. Count a hundred by tens.

Ans. Ten, twenty, thirty, forty, fifty, sixty, seventy, eighty, ninety, hundred.

Ten ones equal one ten	**(10 ones = 1 ten)**
Ten tens equal one hundred	**(10 tens = 1 hund.)**
Ten cents equal one dime	**(10¢ = 1 d.)**
Ten dimes equal one dollar	**(10 d. = $1)**

ADDITION AND SUBTRACTION

Add 30 and 40.

30 = 3 tens, 40 = 4 tens; 3 tens + 4 tens = 7 tens = 70.

$$\begin{array}{r} 30 \\ \underline{40} \\ 70 \end{array}$$

Subtract 20 from 50.

50 = 5 tens, 20 = 2 tens; 5 tens − 2 tens = 3 tens = 30.

$$\begin{array}{r} 50 \\ \underline{20} \\ 30 \end{array}$$

Add:

1.	20	30	40	60	50	80	30	10
	10	20	50	20	50	20	60	90
2.	20	40	60	40	70	30	30	50
	70	30	40	40	30	30	50	20

Subtract:

3.	40	70	60	80	50	90	100	100
	20	30	40	50	30	40	30	60
4.	70	80	50	90	90	80	100	100
	50	20	40	30	70	40	20	50

Complete:

5. 20 + 60 + 10 = —

6. 40 + 10 + 50 = —

7. 60 + 30 − 20 = —

8. 70 + 20 − 60 = —

9. 70 + 20 + 10 = —

10. 30 + 30 + 30 = —

11. 30 + 70 − 20 = —

12. 60 + 40 − 70 = —

13. 20 + 20 + 20 = —

14. 20 + 30 + 40 = —

15. 10 + 80 − 50 = —

16. 50 + 50 − 60 = —

7.	40	30	20	50	60	70	20	40
	+ ?	+ ?	+ ?	+ ?	+ ?	+ ?	+ ?	+ ?
	90	70	80	70	90	100	100	100

Complete:

1. 20 quarts and 30 quarts are —— quarts.
2. 30 pearls and 40 pearls are —— pearls.
3. 60 plates and 20 plates are —— plates.
4. 30 knives and 50 knives are —— knives.
5. 40 prunes less 10 prunes are —— prunes.
6. 70 apples less 20 apples are —— apples.
7. 80 inches less 50 inches are —— inches.
8. 60 horses less 30 horses are —— horses.
9. 70 grapes and 30 grapes are —— grapes.
10. 60 houses and 40 houses are —— houses.
11. 80 chairs and 20 chairs are —— chairs.
12. 90 tables less 30 tables are —— tables.
13. 100 pears less 10 pears are —— pears.
14. 100 slates less 30 slates are —— slates.

15. In one pasture there are 50 cows and in another 40 In both pastures there are —— cows.

16. John paid 90 cents for a cap and 60 cents for a tie. The cap cost —— cents more than the tie.

17. There are 30 days in June and 30 days in April. In both months there are —— days.

18. Mary raised 80 chickens, sold 30, and has —— chickens left.

19. If you spend 50 cents for cloth, 30 cents for ribbon, and 10 cents for thread, you spend in all —— cents.

20. Henry had 60 cents. He earned 40 cents more and then spent 30 cents. He had —— cents left.

How many are 3 × 20?

3 × 2 tens = 6 tens = 60.

$$\begin{array}{r} 20 \\ \underline{3} \\ 60 \end{array}$$

How many are $\frac{1}{3}$ of 90?

$\frac{1}{3}$ of 9 tens = 3 tens = 30.

$$\begin{array}{r} 3\underline{)90} \\ 30 \end{array}$$

How many are 80 ÷ 40?

8 tens ÷ 4 tens = 2.

$$\begin{array}{r} 40\underline{)80} \\ 2 \end{array}$$

Find:

1. 2 × 20 2. 4 × 20 3. 2 × 30 4. 5 × 20
5. 3 × 20 6. 3 × 30 7. 2 × 50 8. 2 × 40
9. 20 ÷ 2 10. 60 ÷ 3 11. 80 ÷ 4 12. 90 ÷ 3
13. 40 ÷ 2 14. 80 ÷ 2 15. 60 ÷ 2 16. 100 ÷ 5
17. $\frac{1}{2}$ of 60 18. $\frac{1}{3}$ of 90 19. $\frac{1}{2}$ of 40 20. $\frac{1}{3}$ of 60
21. $\frac{1}{2}$ of 100 22. $\frac{1}{2}$ of 80 23. $\frac{1}{4}$ of 80 24. $\frac{1}{5}$ of 100

25. A rope is 60 ft. long. If it is cut into 2 equal parts, what will be the length of each part?

26. A father divided 90 apples equally among his 3 daughters. How many apples did each receive?

27. How many 20's are there in 80?

28. There are 100 cherries in a basket. How many girls can have 20 cherries each?

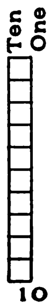
29. Mary has 60 chickens and Ann has $\frac{1}{3}$ as many as Mary. How many chickens has Ann?

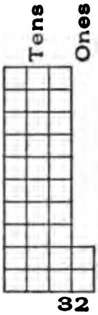
30. How many 30's are there in 90?

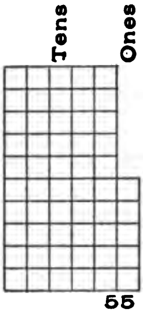
31. Marcus read 80 pages, which was 4 times as many as Henry read. How many pages did Henry read?

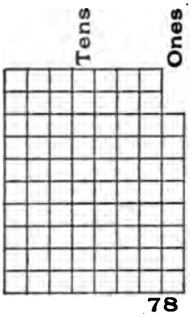
IV. TENS AND ONES — FROM 1 TO 100

NOTATION AND NUMERATION


Ten


Thirty-two


Fifty-five


Seventy-eight

1. Count by ones from ten to forty; from forty to seventy; from seventy to one hundred.

2. How many tens and ones are there in 32? in 55? in 78? in 47? in 80? in 69?

3. 1 ten 3 ones is written 13, and read thirteen.

4. 2 tens 5 ones is written 25, and read twenty-five.

5. 4 tens 6 ones is written 46, and read forty-six.

6. 6 tens 4 ones is written ——, and read ——.

7. 5 tens 1 one is written ——, and read ——.

8. 88 means —— tens —— ones, and is read ——.

9. 72 means —— tens —— ones, and is read ——.

10. 99 means —— tens —— ones, and is read ——.

When a whole number is expressed by two figures, the figure at the left denotes **tens**, and the figure at the right denotes **ones**.

Reading and writing numbers.

Read:

11
12
13
14
15
16
17
18
19

20
30
40
50
60
70
80
90
100

21
32
43
54
65
76
87
98
99

47
73
66
81
57
31
22
93
83

82
56
95
94
63
45
35
25
72

79
49
84
53
29
68
41
39
96

30
85
58
28
97
38
74
48
60

Reading numbers is called **numeration.**

Write in figures:

Eleven
Twenty
Eighty
Fifteen
Twelve
Ninety
Sixteen
Seventy
Thirty
Thirteen
Hundred

Fifty-four
Forty-nine
Sixty-five
Ninety-one
Twenty-six
Thirty-two
Sixty-nine
Forty-four
Fifty-five
Seventeen
Fifty-one

Twenty-seven
Forty-seven
Ninety-four
Twenty-two
Ninety-six
Eighty-one
Forty-eight
Thirty-nine
Fifty-three
Forty-five
Sixty-four

Seventy-four
Thirty-seven
Ninety-eight
Twenty-three
Eighty-nine
Thirty-six
Fifty-eight
Ninety-nine
Seventy-three
Eighty-four
Thirty-eight

Writing numbers in figures is called **notation.**

PRELIMINARY REVIEW

For illustration of the terms used on this page, the pupil may refer to page 24.

1. What number is the sum of 10 and 4? 9 and 5? 8 and 6? 7 and 7?

2. Name all the pairs of numbers less than 11 whose sum is 11; 12; 13; 14; 15; 16; 17; 18.

3. How many, then, are 8 + 7? 9 + 6? 7 + 5? 8 + 9?

4. How many are 11 less 5? 12 less 6? 13 less 7? 14 less 8? 15 less 9?

5. Name, in like manner, all the pairs of numbers, one greater and the other less than 10, whose difference is 2; 3; 4; 5; 6; 7; 8; 9.

6 How many, then, are 13 − 5? 16 − 9? 15 − 7? 17 − 8?

7. Find 5 + 5 + 5 by addition. Find it by multiplication.

8. Find 3 × 6 by addition. Find it by multiplication.

9. How many are 5 × 3? 2 × 7? 4 × 4? 2 × 10?

10. How many 3's are there in 6? in 12? in 6 + 12?

11. How many 2's are there in 8? in 14? in 14 − 8?

12. How many 2's are there in 6 + 8? Then find 6 + 8 by multiplication.

(3 twos + 4 twos = 7 twos = 7 × 2 = 14.)

Find the following by multiplication:

13. 2 + 6 *14.* 4 + 8 *15.* 6 + 12 *16.* 18 − 9

Find the following, and make applications:

17. 9 + 6 *18.* 17 − 9 *19.* 5 × 4 *20.* 18 ÷ 6
21. 4 + 9 *22.* 14 − 9 *23.* 6 × 3 *24.* $\frac{1}{3}$ of 15

ADDITION

Sight addition.

1	1	11	21	31	41	51	61	71	81	91
	2	2	2	2	2	2	2	2	2	2

Instead of 2, add 1, 3; 4; 5; 6; 7; 8; 9.

2.	2	12	22	32	42	52	62	72	82	92
	3	3	3	3	3	3	3	3	3	3

Instead of 3, add 1; 2; 4; 5; 6; 7; 8; 9.

3.	3	13	23	33	43	53	63	73	83	93
	5	5	5	5	5	5	5	5	5	5

Instead of 5, add 1; 2; 3; 4; 6; 7; 8; 9.

4.	4	14	24	34	44	54	64	74	84	94
	7	7	7	7	7	7	7	7	7	7

Instead of 7, add 1; 2; 3; 4; 5; 6; 8; 9.

5. Add 4 to 5; 15; 25; 35; 45; 55; 65; 75; 85; 95.
Instead of 4, add 1; 2; 3; 5; 6; 7; 8; 9.

6. Add 6 to 6; 16; 26; 36; 46; 56; 66; 76; 86; 96.
Instead of 6, add 1; 2; 3; 4; 5; 7; 8; 9.

7. Add 8 to 7; 17; 27; 37; 47; 57; 67; 77; 87; 97.
Instead of 8, add 1; 2; 3; 4; 5; 6; 7; 9.

8. Add 1 to 8; 18; 28; 38; 48; 58; 68; 78; 88; 98.
Instead of 1, add 2; 3; 4; 5; 6; 7; 8; 9.

9. Add 9 to 9; 19; 29; 39; 49; 59; 69; 79; 89; 99.
Instead of 9, add 1; 2; 3; 4; 5; 6; 7; 8.

Add:

1.	19 2	18 5	16 7	18 4	17 7	15 8	14 9	19 9
2.	17 5	16 9	18 8	17 9	19 6	18 9	16 6	17 8
3.	20 7	21 9	28 2	25 2	24 5	23 7	20 5	23 5
4.	25 6	48 7	19 6	37 8	56 4	38 8	42 6	53 7
5.	33 6	55 5	42 8	29 7	34 6	47 7	59 9	48 9
6.	55 7	96 4	78 6	83 9	67 8	74 7	89 4	92 7
7.	61 9	74 8	86 6	91 8	63 5	79 7	82 9	93 4
8.	78 8	85 7	66 9	94 6	68 5	88 9	77 6	92 8
9.	67 3	75 8	83 6	94 5	68 7	78 4	85 5	97 3

Copy and add:

1.	3	4	5	3	6	4	5	7	6	4	5
	7	3	2	9	2	8	7	9	6	2	2
	2	6	4	2	7	6	8	3	6	7	7

2.	2	3	1	2	2	2	3	7	6	2	3
	3	5	3	1	3	2	5	2	1	3	3
	12	11	15	17	13	14	10	11	13	14	15

3.	5	4	5	6	2	7	6	3	5	6	6
	4	3	4	5	3	4	7	3	5	6	7
	3	2	3	4	5	6	3	3	5	6	3
	6	1	2	3	8	3	2	3	5	6	5

4.	2	3	4	5	2	7	3	6	2	4	9
	2	3	4	5	6	3	5	4	3	6	8
	2	8	4	5	6	2	4	3	2	7	7
	2	3	4	5	6	7	2	4	12	8	2

Find:

5. 6 + 4 + 3 3 tops + 6 tops + 7 tops

6. 3 + 6 + 6 3 caps + 4 caps + 8 caps

7. 4 + 6 + 7 2 hats + 6 hats + 5 hats

8. 2 + 3 + 8 3 cups + 4 cups + 9 cups

9. 3 + 5 + 7 2 boys + 2 boys + 7 boys

10. 1 + 6 + 8 3 guns + 3 guns + 3 guns

11. 3 + 4 + 7 4 pens + 4 pens + 4 pens

Copy and add :

1.	8	7	4	6	9	7	3	8	6	4	9
	5	8	7	6	8	6	8	8	5	8	9

2.	3	5	3	5	6	5	7	8	9	8	9
	2	4	4	6	5	6	8	9	5	5	8
	8	7	8	9	7	9	8	7	7	9	8

3.	7	6	5	9	7	8	3	5	6	9	8
	25	68	49	83	37	15	59	76	86	27	78

4.	5	3	6	2	3	4	3	4	7	8	9
	2	7	9	7	5	6	7	8	7	8	9
	8	7	4	8	5	6	6	8	7	8	9
	4	5	8	7	9	6	7	9	7	8	9

5.	4	5	6	7	3	9	4	8	5	7	6
	9	3	8	4	7	5	6	8	2	5	7
	57	86	78	25	49	38	63	55	89	73	87

6.	7	3	9	6	5	7	4	3	5	6	9
	8	5	8	3	4	8	9	2	3	6	7
	6	9	7	5	9	5	3	7	9	8	9
	5	8	10	10	10	10	10	10	10	9	10
	27	38	54	73	41	30	68	49	55	69	65

Like numbers are such as 6 days and 5 days, $7 and $8, 4 boys and 9 boys, 3 tens and 7 tens.

Unlike numbers are such as 6 days and 5 yards, $7 and 8¢, 4 boys and 9 girls, 3 tens and 7 ones.

Can 7 doves and 5 crows be added? Why not?

Can 7 birds and 5 birds be added? Why?

Only like numbers can be added.

Add:

7 doves	$6	3	7¢	5 crows
5 doves	$8	9	7¢	9 crows

Add 13 and 5.

13 is 1 ten 3 ones
5 is 5 ones
Sum is 1 ten 8 ones = 18, *Ans.*

Add:

1. 12	**2.** 15	**3.** 14	**4.** 17	**5.** 11	**6.** 13
4	2	5	2	5	6

7. How many girls are 14 girls and 5 girls?

8. How many birds are 16 birds and 3 birds?

9. How many boxes are 12 boxes and 5 boxes?

10. How many trees are 11 trees and 7 trees?

11. How many traps are 12 traps and 7 traps?

12. Jane had 13 birds and Frank gave her 4 more. How many had she then?

13. John is 14 years old and Ben is 4 years older. How old is Ben?

14. Warren killed 3 squirrels and Jack 13. How many did both kill?

15. Joseph caught 11 fish and John 5. How many did both catch?

Lucy has 43 roses in one basket and 25 in another. How many has she in both baskets?

How many ones are 5 ones and 3 ones?
Write the number of ones under the ones.
How many tens are 2 tens and 4 tens?
Write the number of tens under the tens.
How do you read 6 tens and 8 ones?
What, then, is the number of roses?

$$\begin{array}{r}43\\ \underline{25}\\ 68\end{array}$$

Add:

1.	2.	3.	4.	5.
16	34	65	48	72
32	21	33	51	25

6.	7.	8.	9.	10.
54	23	85	92	40
35	46	13	6	28

11.	12.	13.	14.	15.
24	35	42	50	65
13	20	36	26	24
31	12	11	2	10

16.	17.	18.	19.	20.
16	42	63	21	32
12	31	2	22	34
20	4	20	23	20
30	10	4	30	12

21. How many are 13 + 22 + 3?

22. How many are 24 + 12 + 30 + 2?

23. In one class there are 23 boys and 34 girls. How many pupils are there in the class?

24. Charles caught 34 fish, Robert caught 23, and Tom 30. How many did they catch all together?

25. Nora took 24 lemons to a picnic, Ruth took 30, and Carrie 32. How many did they take all together?

One pig weighs 54 pounds and another 38 pounds. How much do both weigh?

How many ones are 8 ones and 4 ones?

12 ones are how many tens and ones?

Write the 2 (ones) under the ones, and carry the one ten to be added to the tens.

$$\begin{array}{r} 54 \\ \underline{38} \\ 92 \end{array}$$

How many tens are 1 ten, 3 tens, and 5 tens?

Write the number of tens under the tens.

How much, then, do both pigs weigh?

Add the following:

1. 54 27	**2.** 32 29	**3.** 19 45	**4.** 68 25	**5.** 77 23
6. 84 9	**7.** 46 46	**8.** 65 17	**9.** 36 64	**10.** 38 48
11. 28 39	**12.** 47 38	**13.** 67 27	**14.** 76 19	**15.** 58 36
16. 32 28 16	**17.** 46 37 15	**18.** 28 24 23	**19.** 37 25 18	**20.** 25 37 29
21. 17 3 58	**22.** 28 18 38	**23.** 27 28 29	**24.** 36 49 15	**25.** 39 29 19
26. 16 13 48 15	**27.** 24 37 18 19	**28.** 17 17 17 29	**29.** 28 19 27 18	**30.** 19 19 19 19

31. How many are $36 + 9 + 28 + 14$? $45 + 16 + 4 + 30$?

SUBTRACTION

Sight subtraction.

1.	14	24	34	44	54	64	74	84	94
	1	1	1	1	1	1	1	1	1

Instead of 1, subtract 2; 3; 4; 5; 6; 7; 8; 9.

2.	13	23	33	43	53	63	73	83	93
	2	2	2	2	2	2	2	2	2

Instead of 2, subtract 1; 3; 4; 5; 6; 7; 8; 9.

3.	15	25	35	45	55	65	75	85	95
	3	3	3	3	3	3	3	3	3

Instead of 3, subtract 1; 2; 4; 5; 6; 7; 8: 9.

4.	12	22	32	42	52	62	72	82	92
	4	4	4	4	4	4	4	4	4

Instead of 4, subtract 1; 2; 3; 5; 6; 7; 8; 9.

5. Subtract 5 from 16; 26; 36; 46; 56; 66; 76; 86; 96. Instead of 5, subtract 1; 2; 3; 4; 6; 7; 8; 9.

6. Subtract 6 from 11; 21; 31; 41; 51; 61; 71; 81; 91 Instead of 6, subtract 1; 2; 3; 4; 5; 7; 8; 9.

7. Subtract 7 from 18; 28; 38; 48; 58; 68; 78; 88; 98. Instead of 7, subtract 1; 2; 3; 4; 5; 6; 8; 9.

8. Subtract 8 from 17; 27; 37; 47; 57; 67; 77; 87; 97. Instead of 8, subtract 1; 2; 3; 4; 5; 6; 7; 9.

9. Subtract 9 from 10; 20; 30; 40; 50; 60; 70; 80; 90. Instead of 9, subtract 1; 2; 3; 4; 5; 6; 7; 8.

10. From 19, 29, etc., subtract 1; 2; 3; 4; 5; 6; 7; 8; 9.

Subtract:

1.	25	21	26	23	25	22	24	27	28
	6	8	7	4	8	5	7	8	9
2.	31	35	42	47	54	51	65	63	72
	6	7	8	9	8	7	9	6	7
3.	24	22	35	31	44	73	21	82	91
	6	4	6	5	5	7	4	6	3
4.	65	86	99	88	79	97	76	79	
	4	4	5	5	7	2	3	8	
5.	80	62	95	73	82	61	85	76	
	7	8	7	9	7	9	7	8	
6.	94	66	84	73	92	65	72	90	
	6	8	7	4	8	7	6	4	
7.	68	63	82	72	93	71	62	81	
	3	6	7	8	6	9	5	5	
8.	64	91	71	83	74	65	82	94	
	8	8	7	5	6	8	8	9	
9.	93	85	74	60	84	67	92	76	
	8	6	9	8	5	9	4	7	

1. There are 15 letters in my name and 9 in yours. How many more letters are there in my name than in yours?

2. A farmer who had 47 bushels of potatoes sold 8. How many bushels had he left?

3. Gordon traveled 35 miles one day and 7 miles less the next. How far did he go the second day?

4. Maggie bought 64 peaches, and gave 6 of them to Ann. How many had she left?

5. I have 54 pears in one basket and 5 in another. How many more pears have I in the first than in the second?

6. Mary had 75 chickens and lost 8. How many had she left?

7. Robert paid 43 cents for a ball and 7 cents for a bat. How much more did the ball cost than the bat?

8. Simon has 48 marbles and Jack has 9. How many more has Simon than Jack?

9. Wilbur gave Nora 34 pinks and Alice 8. How many more did he give Nora than Alice?

10. Florence missed 9 questions out of 87. How many did she answer?

11. Carrie has 25 roses and 6 lilies. How many more roses has she than lilies?

12. James bought 63 apples and gave 5 of them to a friend. How many had he left?

13. A lady traveled 77 miles by land and 9 miles less by water. How far did she go by water?

14. Walter had 96 marbles and lost 7. How many marbles had he left?

ADDITION AND SUBTRACTION

Copy and complete :

1. 26 + 4 − 3 = —
2. 21 + 3 − 6 = —
3. 17 + 8 − 6 = —
4. 22 + 5 − 3 = —
5. 19 + 7 − 5 = —
6. 20 + 7 − 9 = —
7. 8 + 19 − 7 = —
8. 23 + 6 − 4 = —
9. 15 + 8 − 6 = —
10. 24 + 5 − 8 = —
11. 6 + 17 − 8 = —
12. 25 + 4 − 5 = —
13. 8 + 18 − 5 = —
14. 27 + 3 − 7 = —
15. 13 + 6 + — = 25
16. 9 + 8 + — = 22
17. 17 + 5 + — = 29
18. 7 + 7 + — = 21
19. 18 + 5 + — = 25
20. 13 + 13 + — = 28
21. 19 + 7 + — = 30
22. 14 + 6 + — = 25
23. 18 + 7 + — = 28
24. 15 + 2 + — = 24

25.	**26.**	**27.**	**28.**	**29.**	**30.**	**31.**	**32.**	**33.**
8	9	6	7	6	4	9	8	6
3	6	4	7	5	9	7	5	3
—	—	—	—	—	—	—	—	—
17	16	18	19	17	18	20	20	20

34.	**35.**	**36.**	**37.**	**38.**	**39.**	**40.**	**41.**	**42.**
5	13	14	2	3	2	7	12	11
14	12	13	5	6	11	14	13	7
?	?	?	?	?	?	?	?	?
28	27	30	29	26	21	29	30	27

43. 5 + 2 + 9 + 4 − 1 − 7 = —
44. 6 + 4 + 8 + 3 − 2 − 5 = —

Julia had 47 cherries, but gave 13 of them to Ann. How many had Julia left?

3 ones from 7 ones leaves how many ones?
Write the number of ones under the ones.
1 ten from 4 tens leaves how many tens?
Write the number of tens under the tens.
How many cherries, then, had Julia left?

$$\begin{array}{r}47\\ \underline{13}\\ 34\end{array}$$

Subtract:

1. $\begin{array}{r}56\\ \underline{24}\end{array}$ **2.** $\begin{array}{r}73\\ \underline{51}\end{array}$ **3.** $\begin{array}{r}68\\ \underline{17}\end{array}$ **4.** $\begin{array}{r}49\\ \underline{37}\end{array}$ **5.** $\begin{array}{r}88\\ \underline{35}\end{array}$

6. $\begin{array}{r}94\\ \underline{54}\end{array}$ **7.** $\begin{array}{r}39\\ \underline{16}\end{array}$ **8.** $\begin{array}{r}86\\ \underline{21}\end{array}$ **9.** $\begin{array}{r}97\\ \underline{26}\end{array}$ **10.** $\begin{array}{r}99\\ \underline{38}\end{array}$

11. How many caps are 47 caps less 15 caps?

12. How many books are 78 books − 26 books?

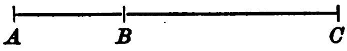
13. Ann paid 45 cents for a doll and 25 cents for a fan. How much more did the doll cost than the fan?

14. Frank weighs 89 pounds and Ben weighs 74 pounds. How much more does Frank weigh than Ben?

15. How many more is 76 than 34?

16. Find the difference between 97 and 54.

17. From city *A* to city *B* is 32 miles; and from *A* to city *C* is 69 miles. How far is it from *B* to *C*?



18. An empty car weighs 23 tons, and when loaded it weighs 59 tons. How much does the load weigh?

19. Find the value of $36 + 53 - 45$.

Susan has read 63 pages of a book and Jane 38. How many more pages has Susan read than Jane?

$$\begin{array}{rl} 63 = & 5 \text{ tens } 13 \text{ ones} \\ 38 = & \underline{3 \text{ tens } \ \ 8 \text{ ones}} \\ & 2 \text{ tens } \ \ 5 \text{ ones} \end{array} \qquad \begin{array}{r} 63 \\ \underline{38} \\ 25 \end{array}$$

Can 8 ones be subtracted from 3 ones?
Then take 1 ten from 6 tens and unite it with 3 ones.
How many ones are 1 ten and 3 ones?
Then 8 ones from 13 ones leaves how many ones?
Write the number under the ones.
6 tens less 1 ten are how many tens?
Then 3 tens from 5 tens leaves how many tens?
Write the number under the tens.
How many more pages, then, has Susan read than Jane?
In practice consider 3 as 13 and 6 as 5.

Subtract:

1.	33	**2.**	42	**3.**	65	**4.**	70	**5.**	100
	18		25		37		46		63
6.	86	**7.**	93	**8.**	50	**9.**	80	**10.**	100
	49		54		17		32		54
11.	71	**12.**	83	**13.**	25	**14.**	74	**15.**	100
	43		76		9		28		76
16.	57	**17.**	85	**18.**	43	**19.**	92	**20.**	66
	28		57		17		38		47

21. Find the value of $36 + 58 - 29$.
22. Find the value of $47 + 46 - 38$.
23. Find the value of $56 + 29 - 47$.

1. James had 45 cents. He spent 18 cents. How many cents had he then?

2. Emma bought a pound of butter for 35 cents, and gave the clerk a half dollar. How much change should she receive?

3. A man starts to go 73 miles. After he has gone 26 miles, how much farther will he have to go?

4. Kate invited 34 girls to her party, and only 18 of them attended. How many were absent?

5. A lady had $100 and spent all of it except $17. How much did she spend?

6. George threw a ball 84 yards and Roy threw it 69 yards. How much farther did George throw it than Roy?

7. How much more than 48 cents do you need to buy a knife worth 75 cents?

8. Clarence jumped 80 inches and William 67 inches. How much did Clarence beat William?

9. How many days are there in May? How many days of May come after May 17?

10. George is 16 years old. In how many years will he be 40 years old?

11. Fannie has 81 picture post cards, and Kate has 63. How many more has Fannie than Kate?

12. One bin contains 93 bushels of wheat and another 74 bushels. How much more does the first contain than the second?

13. A train which contains 56 cars, separates between the 19th and 20th cars. How many more cars does the longer section contain than the shorter?

Making change.

A nickel = 5 ¢.
A dime = 2 nickels = 10 ¢.
A quarter (¼ of $1) = 5 nickels = 25 ¢.
A half dollar (½ of $1) = 2 quarters = 10 nickels = 50 ¢.

In making change it is advisable for the pupils to use toy money, or circular pieces of cardboard representing cents, nickels, dimes, quarters, and halves. The pupils may act as clerk in turn.

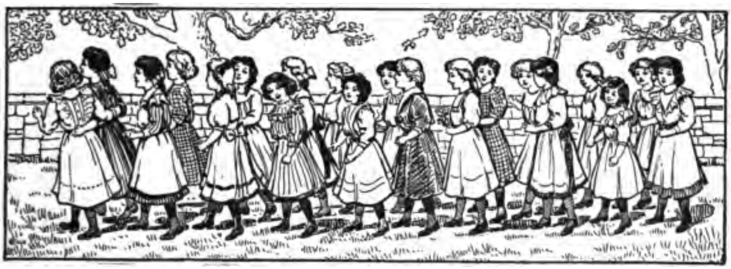
Mary bought a book for 30 ¢ and a pencil for 3 ¢, and handed the clerk a half dollar. What should the clerk do and say in making change?

Ans. Your bill is 33 ¢; then give Mary 1 ¢, and say "34"; then 1 ¢, and say "35"; then a nickel, and say "40"; then a dime, and say "50."

Make change for the following purchases, the last sum named being the amount handed the clerk in payment:

1. Apples 15¢, cherries 4 ¢; 25 ¢.
2. Pears 12¢, pens 3 ¢, matches 2¢; 25¢.
3. Rice 8¢, prunes 10¢, popcorn 5¢; 25¢.
4. Plums 20¢, sugar 10¢, pepper 8¢; 50¢.
5. Potatoes 18 ¢, bread 8¢, turnips 5¢; 50¢.
6. A knife 25 ¢, a ball 10 ¢, a bat 8 ¢; 50 ¢.
7. Lard 15¢, coffee 12 ¢, ham 17¢; 50 ¢.
8. Peanuts 18¢, sugar 5¢, rice 6¢; 50¢.
9. Starch 4¢, sirup 35¢, matches 3¢; 50 ¢.
10. Celery 15¢, lettuce 14¢, spinach 8¢; 50¢.
11. A bucket 26¢, a cup 8¢, a shovel 7¢; 50¢.
12. Lard 16¢, rice 6¢, starch 5¢; 50¢.
13. A gun $18, a saddle $14, a bridle $2; $50.

MULTIPLICATION AND DIVISION



1. How many girls are there in the picture?

2. Count the girls by *twos*.

Thus, two, four, six, and so on.

3. Now count them thus: 1 two is 2; 2 twos are 4; 3 twos are 6; 4 twos are 8; and so on to 10 twos.

4. How many girls are 2 times 2 girls? 3×2 girls? 4×2 girls? Continue to 10×2 girls.

5. How many are $2 + 2 + 2 + 2 + 2 + 2$?

6. How many 2's are there, then, in 12?

7. How many are $12 \div 2$? $\frac{1}{2}$ of 12?

8. How many are 8×2? | |, | |, | |, | |, | |, | |, | |, | |.

9. How many 2's are there, then, in 16?

10. If 16 is divided into two equal parts, what will one of the parts be?

11. How many, then, are $\frac{1}{2}$ of 16?

12. Find, by marks, how many times 2 is contained in 14; in 18; in 20.

13. How many, then, are $14 \div 2$? $18 \div 2$?

14. How many are 2×6? 2×7? 2×9?

15. How many, then, are $\frac{1}{2}$ of 12? $\frac{1}{2}$ of 14? $\frac{1}{2}$ of 18?

Building the multiplication and division tables of 2's.

Complete the following:

1×2 is $2 = 2$
2×2 are $2 + 2 = 4$
3×2 are $2 + 2 + 2 =$ ——
4×2 are $2 + 2 + 2 + 2 =$ ——
5×2 are $2 + 2 + 2 + 2 + 2 =$ ——
6×2 are $2 + 2 + 2 + 2 + 2 + 2 =$ ——
7×2 are $2 + 2 + 2 + 2 + 2 + 2 + 2 =$ ——
8×2 are $2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 =$ ——
9×2 are $2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 =$ ——
10×2 are $2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 =$ ——

Now copy and arrange the results as follows, and commit the tables to memory:

$1 \times 2 = 2$, $2 \div 2 = 1$
$2 \times 2 = 4$, $4 \div 2 = 2$
$3 \times 2 = 6$, $6 \div 2 = 3$
$4 \times 2 = 8$, $8 \div 2 = 4$
$5 \times 2 = 10$, $10 \div 2 = 5$
$6 \times 2 = 12$, $12 \div 2 = 6$
$7 \times 2 = 14$, $14 \div 2 = 7$
$8 \times 2 = 16$, $16 \div 2 = 8$
$9 \times 2 = 18$, $18 \div 2 = 9$
$10 \times 2 = 20$, $20 \div 2 = 10$

1. If one orange costs 6¢, how much will 2 oranges cost?

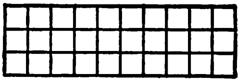
2. Frank has 8 marbles in each hand. How many has he in both hands?

3. There are 18 pears on the table. How many girls can have 2 pears each?

4. If Henry steps 2 feet at a time, how many steps will he make in walking a log which is 20 feet long?

5. Lucy has 14 roses and Mary has half as many. How many roses has Mary?

Counting by threes.



1. Count the squares in this oblong.
2. Count them by *threes.*

Thus: *three*, *six*, *nine*, and so on.

3. Now count them by threes, thus: 1 three is 3; 2 threes are 6; 3 threes are 9; and so on to 10 threes.
4. How many tops are 2×3 tops? 3×3 tops? 4×3 tops? Continue to 10×3 tops.
5. How many 3's are there in 6? in 9? 12? 15? 18?
6. How many times is 3 contained in 21? 24? 27?
7. How many are $\frac{1}{3}$ of 6? $\frac{1}{3}$ of 15? $\frac{1}{3}$ of 24?
8. How many are $12 \div 3$? $18 \div 3$? $27 \div 3$?

Building the multiplication and division tables of 3's.

Complete:

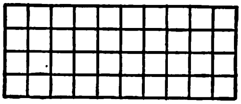
1×3 is $3 = 3$
2×3 are $3 + 3 = 6$
3×3 are $3 + 3 + 3 =$ ——
4×3 are $3 + 3 + 3 + 3 =$ ——
5×3 are $3 + 3 + 3 + 3 + 3 =$ ——
6×3 are $3 + 3 + 3 + 3 + 3 + 3 =$ ——
7×3 are $3 + 3 + 3 + 3 + 3 + 3 + 3 =$ ——
8×3 are $3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 =$ ——
9×3 are $3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 =$ ——
10×3 are $3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 =$ ——

Write the results, and commit the tables to memory:

$1 \times 3 = 3$, $3 \div 3 = 1$
$2 \times 3 = 6$, $6 \div 3 = 2$
$3 \times 3 = 9$, $9 \div 3 = 3$
$4 \times 3 = 12$, $12 \div 3 = 4$
$5 \times 3 = 15$, $15 \div 3 = 5$

$6 \times 3 = 18$, $18 \div 3 = 6$
$7 \times 3 = 21$, $21 \div 3 = 7$
$8 \times 3 = 24$, $24 \div 3 = 8$
$9 \times 3 = 27$, $27 \div 3 = 9$
$10 \times 3 = 30$, $30 \div 3 = 10$

Counting by fours.



1. Count the squares in this oblong.

2. Count them by *fours*.

Thus: *four, eight, twelve,* and so on.

3. Now count them by fours, thus: 1 four is 4; 2 fours are 8; 3 fours are 12; and so on to 10 fours.

Build the following multiplication and division tables of 4's just as the tables of 3's are built on page 67, and commit them to memory:

$1 \times 4 = 4$, $4 \div 4 = 1$ $6 \times 4 = 24$, $24 \div 4 = 6$
$2 \times 4 = 8$, $8 \div 4 = 2$ $7 \times 4 = 28$, $28 \div 4 = 7$
$3 \times 4 = 12$, $12 \div 4 = 3$ $8 \times 4 = 32$, $32 \div 4 = 8$
$4 \times 4 = 16$, $16 \div 4 = 4$ $9 \times 4 = 36$, $36 \div 4 = 9$
$5 \times 4 = 20$, $20 \div 4 = 5$ $10 \times 4 = 40$, $40 \div 4 = 10$

4. John has 7 sacks and 4 marbles in each sack. How many marbles has he in all?

5. How far can you ride in 6 hours in a buggy that travels 4 miles an hour?

6. If 32 apples are divided equally among 4 boys, how many apples will each boy receive?

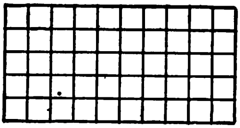
7. If oranges are worth 4 cents each, how many oranges can I buy for 20 cents?

8. How many quarts are there in 9 gallons?

9. How many bushels are there in 16 pecks?

10. Robert had 24 marbles and lost $\frac{1}{4}$ of them. How many marbles did he lose?

Counting by fives.



1. How many squares are there in this oblong?

2. Count them by *fives.*

Thus: *five, ten, fifteen,* and so on to fifty.

3. Now count them by 5's, thus: 1 five is 5; 2 fives are 10; 3 fives are 15; and so on to 10 fives.

4. How many are 6×5? 4×5? 9×5?

5. How many 5's are there in 25? in 40? in 35?

6. When a thing is divided into five equal parts, each part is one fifth ($\frac{1}{5}$) of the thing divided.

7. How much is $\frac{1}{5}$ of 15 squares? $\frac{1}{5}$ of $30? $\frac{1}{5}$ of 45¢?

Build the following multiplication and division tables of 5's as you built the tables of 3's and 4's, and commit them to memory:

$1 \times 5 = 5$, $5 \div 5 = 1$
$2 \times 5 = 10$, $10 \div 5 = 2$
$3 \times 5 = 15$, $15 \div 5 = 3$
$4 \times 5 = 20$, $20 \div 5 = 4$
$5 \times 5 = 25$, $25 \div 5 = 5$

$6 \times 5 = 30$, $30 \div 5 = 6$
$7 \times 5 = 35$, $35 \div 5 = 7$
$8 \times 5 = 40$, $40 \div 5 = 8$
$9 \times 5 = 45$, $45 \div 5 = 9$
$10 \times 5 = 50$, $50 \div 5 = 10$

8. Mary has 8 cherries, and Ann has 5 times as many. How many cherries has Ann?

9. Frank sold 6 oranges at 5¢ each. How much did he receive for all of them?

10. There are 45 pears in a basket. How many girls can have 5 pears each?

11. If a horse travels 35 miles in 5 hours, what is its average speed per hour?

Multiply quickly:

2	3	2	3	4	5	2	3	5	3
2	3	5	9	8	6	6	8	9	7
5	3	2	4	2	4	5	3	2	4
5	6	8	7	7	9	8	5	9	6

Find:

1. 5 × 2 cents; 6 × 3 fans; 7 × $4.
2. 4 × 5 cents; 7 × 2 ants; 9 × $3.
3. 4 × 3 beads; 8 × 3 pigs; 5 × $5.
4. 9 × 2 books; 4 × 4 eggs; 9 × $4.
5. 5 × 3 trees; 8 × 2 bugs; 10 × $2.
6. 3 × 4 hours; 9 × 2 boys; 7 × $3.

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7. An orange cost 5¢ and a melon cost 6 times as much. How much did the melon cost?

8. Nora found 5 birds' nests with 4 eggs in each. How many eggs were there in all?

9. If plums sell at 5¢ a dozen, how much will 7 dozen cost?

10. There are 4 pecks in a bushel. How many pecks are there in 6 bushels?

11. If a pound of sugar costs 5¢, how much will 8 pounds cost?

12. John walked 4 miles and William rode 7 times as far. How far did William ride?

13. There are 9 benches on the lawn and 5 girls on each bench. How many girls are there in all?

14. Emma has 4 roses and Ella has 8 times as many. How many roses has Ella?

The numbers 5, 10, 15, 20, etc., are called the **multiples** of 5, because each is obtained by multiplying 5 by some number.

1. Write the first ten multiples of 2.

Ans. 2, 4, 6, 8, 10, 12, 14, 16, 18, 20.

2. Are these the numbers we name in counting by 2's?

3. Count from 3 to 30 by 3's. Name the first ten multiples of 3.

4. Name the first ten multiples of 4. Name them backward.

5. Is 12 a multiple of 3?

6. Does 12 contain 3 an exact number of times? How many times?

This is written $12 \div 3 = 4$, or $\frac{12}{3} = 4$, or $\begin{array}{r}3\underline{)12}\\4\end{array}$, which may be read, 12 contains 3 four times, or 12 divided by 3 equals 4.

Any multiple of a number contains the number an exact number of times.

Give answers or quotients quickly:

$4 \div 2$	$9 \div 3$	$8 \div 2$	$6 \div 3$	$28 \div 4$	$12 \div 3$	$30 \div 5$
$6 \div 2$	$8 \div 4$	$5 \div 5$	$4 \div 4$	$15 \div 3$	$32 \div 4$	$12 \div 2$
$\frac{15}{5}$	$\frac{16}{4}$	$\frac{10}{2}$	$\frac{21}{3}$	$\frac{24}{4}$	$\frac{25}{5}$	$\frac{36}{4}$
$\frac{18}{3}$	$\frac{20}{5}$	$\frac{24}{3}$	$\frac{16}{2}$	$\frac{35}{5}$	$\frac{27}{3}$	$\frac{18}{2}$
$5\underline{)10}$	$4\underline{)12}$	$5\underline{)40}$	$2\underline{)14}$	$4\underline{)20}$	$4\underline{)32}$	$5\underline{)45}$

7. How many times do 30 yards contain 5 yards?

8. How many times do 28 pints contain 4 pints?

9. How many times is 5 ft. contained in 50 ft.?

1. Essie bought 3 hats at 7 dollars each. How much did all the hats cost?

2. There are 4 quarts in one gallon. How many quarts are there in 5 gallons?

3. If there are 4 mules in a team, how many mules are there in 8 teams?

4. Charley bought 7 two-cent stamps. How much did he spend?

5. How many are 3 times 2, and 4?

Ans. **3 times 2 are 6; 6 and 4 are 10.**

6. How many are 4 times 3, less 5?

Ans. **4 times 3 are 12; 12 less 5 are 7.**

How many are:

7. 5 times 3, and 3? $4 + 4 \times 2$, or $4 + 8$?

8. 4 times 5, less 2? $20 - 3 \times 6$, or $20 - 18$?

The multiplication must be performed first; afterwards the addition or subtraction.

9. 2 times 8, and 3? $5 + 7 \times 4$? $3 + 8 \times 5$?

10. 5 times 2, less 4? $4 \times 4 - 6$? $17 - 6 \times 2$?

11. 2 times 9, and 1? $2 \times 5 + 7$? $5 + 7 \times 2$?

12. 4 times 3, less 6? $6 \times 3 - 2$? $20 - 8 \times 2$?

13. James had 5 times 3 dollars and his mother gave him 3 more. How much had he then?

14. Henry has 4 baskets, and in each 7 apples. How many apples will he have after eating 2?

15. Mary gave each of her 4 brothers 9 pears, and had 3 pears left. How many had she at first?

16. A man desired to give each of his 3 sons $6, but lacked $3 of having enough money. How much had he?

Counting by sixes.

Find the following, first, by addition; and then by multiplying 6 by the number of sixes.

1. $6 + 6$.

Ans. 6 and 6 are 12. 2 sixes $= 2 \times 6 = 12$.

2. $12 + 6$.

Ans. 12 and 6 are 18. 12 is 2 sixes; 2 sixes and 1 six are 3 sixes, and $3 \times 6 = 18$.

3. $18+6$
4. $6+6+12$
5. $24+6$
6. $6+6+6+12$
7. $30+6$
8. $6+6+12+12$
9. $36+6$
10. $6+6+6+24$
11. $42+6$
12. $6+6+18+18$
13. $48+6$
14. $6+6+18+24$

Build the following tables of 6's as you have built the tables of 5's, and commit them to memory:

$1 \times 6 = 6$, $6 \div 6 = 1$
$2 \times 6 = 12$, $12 \div 6 = 2$
$3 \times 6 = 18$, $18 \div 6 = 3$
$4 \times 6 = 24$, $24 \div 6 = 4$
$5 \times 6 = 30$, $30 \div 6 = 5$
$6 \times 6 = 36$, $36 \div 6 = 6$
$7 \times 6 = 42$, $42 \div 6 = 7$
$8 \times 6 = 48$, $48 \div 6 = 8$
$9 \times 6 = 54$, $54 \div 6 = 9$
$10 \times 6 = 60$, $60 \div 6 = 10$

15. If Bob puts 6 marbles in each sack, it will take 7 sacks to hold all he has. How many marbles has he?

16. Rosa has 30¢. How many oranges can she buy at 6¢ each?

17. If 6 yards of cloth cost 54¢, how much will 1 yard cost?

18. How much is $\frac{1}{6}$ of $48?

1. Name the first ten multiples of 6. Call them backward.

2. Name the first nine numbers that 6 will exactly divide.

3. How many times is 6 contained in 18? in 30? in 54? in 24? in 36? in 48? in 12? in 42?

4 How many 6's are there in 42? in 12 + 24? 18 + 42?

5. How many dollars are \$6 + \$6 + \$6 + \$6 + \$6 + \$6? Find the sum by addition; find it by multiplication.

6. There are 6 benches and 7 boys on each bench. How many boys are there in all?

7 Jane wrote 6 lines and put 9 words in each line. How many words did she write?

8. How many plates will it take to hold 48 apples if 6 apples are put in each plate?

9. Ella has 30¢. How many toys can she buy if each toy costs 6¢?

10. How many poles will it take to reach 60 feet, if each pole is 6 feet long?

11. How many marks are here? Into how many equal parts are they separated? ||, ||, ||, ||, ||, ||

12. How many, then, are one sixth ($\frac{1}{6}$) of 12?

13. How many dollars are $\frac{1}{6}$ of \$12? $\frac{1}{6}$ of \$30?

14. Lucy had 42 chickens, but $\frac{1}{6}$ of them died. How many chickens did she lose?

15. I have 54 pears. If I give Frank $\frac{1}{6}$ of them, how many will he have?

Counting by sevens.

1. How many are $7 + 7$? $2 \times 7 = ?$
2. How many 7's are there, then, in 14? $14 \div 7 = ?$
3. How many are $7 + 7 + 7$? $3 \times 7 = ?$
4. How many 7's are there, then, in 21? $21 \div 7 = ?$
5. How many are 4 sevens? $4 \times 7 = ?$
6. How many 7's are there, then, in 28? $28 \div 7 = ?$
7. How many are 5 sevens? $5 \times 7 = ?$
8. How many 7's are there, then, in 35? $35 \div 7 = ?$
9. How many are 6 sevens? $6 \times 7 = ?$
10. How many 7's are there, then, in 42? $42 \div 7 = ?$

Build the following tables of 7's, and commit them to memory:

$1 \times 7 = 7$, $7 \div 7 = 1$
$2 \times 7 = 14$, $14 \div 7 = 2$
$3 \times 7 = 21$, $21 \div 7 = 3$
$4 \times 7 = 28$, $28 \div 7 = 4$
$5 \times 7 = 35$, $35 \div 7 = 5$
$6 \times 7 = 42$, $42 \div 7 = 6$
$7 \times 7 = 49$, $49 \div 7 = 7$
$8 \times 7 = 56$, $56 \div 7 = 8$
$9 \times 7 = 63$, $63 \div 7 = 9$
$10 \times 7 = 70$, $70 \div 7 = 10$

Give a short way of finding the following sums:

11. $7 + 7 + 7$; $7 + 7 + 7 + 7 + 7 + 7 + 7$.
12. $7 + 7$; $7 + 7 + 7 + 7 + 7 + 7 + 7 + 7$.
13. $7 + 7 + 7 + 7$; $7 + 7 + 7 + 7 + 7 + 7$.
14. $7 + 7 + 7 + 7 + 7$; $7 + 7 + 14$.
15. $7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 + 7$.
16. $7 + 7 + 14 + 21$; $14 + 21 + 28$.
17. 7 caps + 7 caps + 7 caps + 7 caps + 7 caps.
18. 7 balls + 7 balls + 7 balls + 21 balls.
19. 14 roses + 7 roses + 21 roses + 28 roses.

1. Which are the first ten multiples of 7? Call them backward.

2. Which one of them is 5 sevens? 3 sevens? 8 sevens? 4 sevens? nine 7's? six 7's? two 7's? seven 7's?

3. How many 7's is 35? 56? 14 + 21? 42 + 49?

4. How many cents are 7¢ + 7¢ + 7¢ + 14¢? Find the sum by addition; by multiplication.

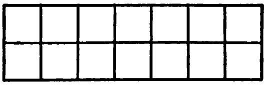
5. How many lilies will it take to give 7 girls 6 lilies apiece? 8 lilies apiece?

6. Frank starts on his bicycle to go from Jackson to Trenton. If he goes 7 miles an hour, it will take him 5 hours to get there. How far is it from Jackson to Trenton?

7. A man has a barrel which holds 56 gallons of water and a keg which holds 7 gallons. How many kegs of water would it take to fill the barrel?

8. Mary paid 35¢ for some ribbon, and the price was 7¢ a yard. How many yards did she buy?

9. How many squares are in this oblong?



10. How many 7's is that?

11. Point out one of the 7 equal parts of 14 squares.

12. How many squares, then, are one seventh ($\frac{1}{7}$) of 14 squares?

13. How many dollars are $\frac{1}{7}$ of $14? $\frac{1}{7}$ of $21?

14. Ben had 42 pears and gave his sister $\frac{1}{7}$ of them. How many pears did he give his sister?

15. How many are $\frac{1}{7}$ of 28? $\frac{1}{7}$ of 49?

Counting by eights, nines, and tens.

Build the following multiplication and division tables of 8's, 9's, and 10's, and commit them to memory:

$1 \times 8 = 8,\quad 8 \div 8 = 1 \qquad 6 \times 8 = 48,\quad 48 \div 8 = 6$
$2 \times 8 = 16,\quad 16 \div 8 = 2 \qquad 7 \times 8 = 56,\quad 56 \div 8 = 7$
$3 \times 8 = 24,\quad 24 \div 8 = 3 \qquad 8 \times 8 = 64,\quad 64 \div 8 = 8$
$4 \times 8 = 32,\quad 32 \div 8 = 4 \qquad 9 \times 8 = 72,\quad 72 \div 8 = 9$
$5 \times 8 = 40,\quad 40 \div 8 = 5 \qquad 10 \times 8 = 80,\quad 80 \div 8 = 10$

$1 \times 9 = 9,\quad 9 \div 9 = 1 \qquad 6 \times 9 = 54,\quad 54 \div 9 = 6$
$2 \times 9 = 18,\quad 18 \div 9 = 2 \qquad 7 \times 9 = 63,\quad 63 \div 9 = 7$
$3 \times 9 = 27,\quad 27 \div 9 = 3 \qquad 8 \times 9 = 72,\quad 72 \div 9 = 8$
$4 \times 9 = 36,\quad 36 \div 9 = 4 \qquad 9 \times 9 = 81,\quad 81 \div 9 = 9$
$5 \times 9 = 45,\quad 45 \div 9 = 5 \qquad 10 \times 9 = 90,\quad 90 \div 9 = 10$

$1 \times 10 = 10,\quad 10 \div 10 = 1 \qquad 6 \times 10 = 60,\quad 60 \div 10 = 6$
$2 \times 10 = 20,\quad 20 \div 10 = 2 \qquad 7 \times 10 = 70,\quad 70 \div 10 = 7$
$3 \times 10 = 30,\quad 30 \div 10 = 3 \qquad 8 \times 10 = 80,\quad 80 \div 10 = 8$
$4 \times 10 = 40,\quad 40 \div 10 = 4 \qquad 9 \times 10 = 90,\quad 90 \div 10 = 9$
$5 \times 10 = 50,\quad 50 \div 10 = 5 \qquad 10 \times 10 = 100,\quad 100 \div 10 = 10$

Give a short way of finding the following sums:

1. $8+8+8$; $9+9+9+9$; $10+10+10+10+10$.
2. $9+9+9$; $8+8+8+8$; $9+9+9+9+9$.
3. $8+8+8+8+8+8$; $9+9+9+9+9+9$.
4. $8+8+8+8+8+8+8+8$; $9+9+9+9$.
5. $9+9+9+9+9+9+9$; $8+8+8+8+8$.

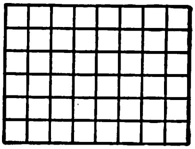
1. Name the first ten multiples of 8. Name them backward.

2. Which of the multiples of 8 is 5 eights? 7 eights? 9 eights? 3 eights? six 8's? four 8's? two 8's? eight 8's?

3. How many 8's are there in 32? in 56? in 16 + 48?

4. A peck measure holds 8 quarts of corn and a bushel measure holds 4 pecks of corn. How many quarts are there in a bushel?

5. If a horse trots 8 miles an hour, in how many hours will it go 40 miles?



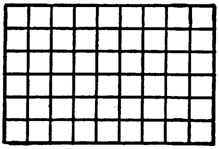
6. How many squares are there in this oblong? Look at the oblong and answer the following:

$8 \times 6 = ?$ $6 \times 8 = ?$ $48 \div 6 = ?$
$48 \div 8 = ?$ $\frac{1}{6}$ of $48 = ?$ $\frac{1}{8}$ of $48 = ?$

7. Name the first ten multiples of 9. Name them backward.

8. Which of the multiples of 9 contain nine 5 times? Which one contains nine 7 times? 3 times? 9 times? 6 times? 2 times? 8 times? 4 times?

9. How many 9's is 45? 72? 18 + 63? 27 + 54?

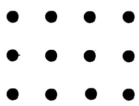


10. Find the number of squares in this oblong in two ways by multiplication.

11. Look at the figure and answer these questions:

$6 \times 9 = ?$ $9 \times 6 = ?$ $54 \div 6 = ?$
$54 \div 9 = ?$ $\frac{1}{6}$ of $54 = ?$ $\frac{1}{9}$ of $54 = ?$

The rows of dots, up and down, are called *columns*, and the rows of dots, right and left, are called *rows*.

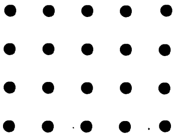


1. How many rows are there? How many dots are there in each row? How many dots, then, are there in all? 3 × 4 dots are how many dots?

2. How many columns are there? How many dots are there in each column? How many dots, then, are there in all? 4 × 3 dots are how many dots?

3. Is 3 × 4 dots, then, the same as 4 × 3 dots?

4. In like manner show by dots that 2 × 3 = 3 × 2.



5. How many dots are 4 × 5 dots? 5 × 4 dots? How do 4 × 5 and 5 × 4 compare?

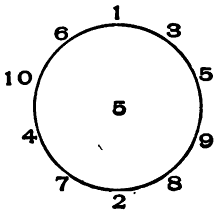
6. Is 8 times 3 as many as 3 times 8? Show it with dots.

7. Show with dots that 6 × 3 = 3 × 6; 7 × 4 = 4 × 7.

8. How much will 4 oranges cost at 5¢ each?

9. How much will 5 oranges cost at 4¢ each?

10. Is 6 × 5¢ just as many cents as 5 × 6¢?



11. Multiply the numbers without the circle, taken in the order written, by the number (5) within.

12. Instead of the figure within, put 2 and multiply as before.

13. Put 3 within and multiply; then 4, 6, 7, 8, 9.

Continue the drill, from day to day, until the combinations are well known.

Sight multiplication.

4 times 6
6 times 7
8 times 2
7 times 9
6 times 5
8 times 7

7 × 2
9 × 2
9 × 6
8 × 4
3 × 5
5 × 8

3 × 4
6 × 6
5 × 5
9 × 4
3 × 3
9 × 8

2 × 3
7 × 5
4 × 7
5 × 4
3 × 7
8 × 8

3 × 9
4 × 4
2 × 5
4 × 2
8 × 6
5 × 9

6 × 3
3 × 8
9 × 9
2 × 2
2 × 6
7 × 7

7 sixes
4 fours
8 fives
5 nines
9 sixes
6 fours
9 fives

4 fives
6 nines
6 sixes
7 fours
5 fives
7 nines
4 sixes

8 nines
9 fours
7 fives
8 sixes
4 nines
5 sixes
8 fours

5 eights
4 sevens
8 threes
6 eights
9 sevens
7 threes
3 eights

5 sevens
3 threes
4 eights
7 sevens
2 eights
3 sevens
9 threes

7 eights
6 sevens
5 threes
8 eights
6 threes
9 eights
8 sevens

1. How much will 7 peaches cost at 3¢ each?

2. If 1 orange is worth 4¢, how much are 6 oranges worth?

3. How much will 7 yards of cloth cost, at 5¢ a yard?

4. How much will 8 barrels of flour cost, at $6 a barrel?

5. How much will 3 tons of hay cost, at $9 a ton?

6. How much will 6 pounds of sugar cost, at 7¢ a pound?

7. How far will a boy walk in 5 hours, at the rate of 3 miles per hour?

8. When oranges are worth $4 a box, how much will 9 boxes cost?

9. Robert had 6 birds in one coop and 3 in another. He sold them all at the rate of 9¢ each. How much did he receive?

Finding the cost of telegrams and "night letters."

PLACE	DAY	NIGHT	PLACE	DAY	NIGHT
New York	60—4	50—3	Raleigh	50—3	40—3
Washington	50—3	40—3	Atlanta	50—3	40—3
Boston	60—4	50—3	Montgomery	40—3	30—2
Chicago	60—4	50—3	Memphis	50—3	40—3
Cincinnati	50—3	40—3	Little Rock	50—3	40—3
St. Louis	50—3	40—3	Austin	50—3	40—3
Richmond	50—3	40—3	Jackson, Miss.	40—3	30—2
Charleston	50—3	40—3	Shreveport	25—2	25—1

This table gives the Western Union's day and night rates from New Orleans to the places named. The rate is the same in either direction. Thus, the day rate to Washington is 50—3, which means 50 cents for the first ten words and 3 cents for each additional word; while the standard night rate is 40 cents for the first ten words and 3 cents for each additional word. The special night rate for telegraphing "*night letters*" of 50 words (or less) is the same as the day rate on 10 words, and $\frac{1}{5}$ of the day rate for every 10 words (or less) over 50 words.

Find the cost of sending from New Orleans:

1. A 16-word telegram to Boston at a day rate.
2. A 72-word "night letter" to Atlanta.

1. 60¢ + 6 × 4¢ = 84¢. 2. 50¢ + 3 × $\frac{1}{5}$ of 50¢ = 80¢.

3. A 20-word telegram to New York at a day rate.
4. A 12-word message to Memphis, standard night rate.
5. A 19-word telegram to Jackson at a day rate.
6. A 55-word "night letter" to Austin.
7. A 65-word "night letter" to Chicago.
8. How much more will a 45-word telegram to Shreveport cost at a day rate than as a "night letter"?
9. Find the cost of a 60-word "night letter" to Jackson.

Sight division.

24 ÷ 6
12 ÷ 4
24 ÷ 8
15 ÷ 3
36 ÷ 4
21 ÷ 7
14 ÷ 2
18 ÷ 2
36 ÷ 9
10 ÷ 5
20 ÷ 4
48 ÷ 6
10 ÷ 2
30 ÷ 6
16 ÷ 2
81 ÷ 9
63 ÷ 9
12 ÷ 6
48 ÷ 8
36 ÷ 6
54 ÷ 6
25 ÷ 5
54 ÷ 9
40 ÷ 8
27 ÷ 9
35 ÷ 5
16 ÷ 4
32 ÷ 4
30 ÷ 5
56 ÷ 8
18 ÷ 3
42 ÷ 7
28 ÷ 7
20 ÷ 5
15 ÷ 5
72 ÷ 8

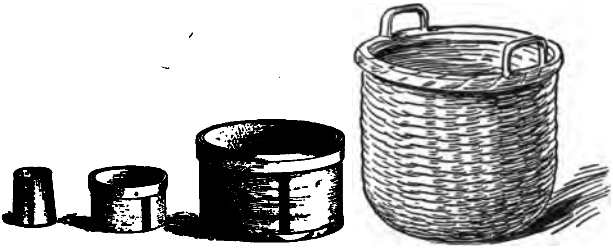
8)64
9)45
8)32
9)72
7)56
3)21
8)16
2)12
7)49
3)27
7)35
7)63
5)45
6)18
6)42
5)40
4)24
3)12
3)24
3) 9
7)14
9)18
4)28
2) 8

1. 6 tops are contained in 24 tops — times.
2. 3 pins are contained in 18 pins — times.
3. 5 rugs are contained in 30 rugs — times.
4. 7 hats are contained in 49 hats — times.
5. 8 caps are contained in 40 caps — times.
6. 9 cans are contained in 63 cans — times.
7. 6 beds are contained in 54 beds — times.
8. 8 feet are contained in 64 feet — times.
9. 9 rods are contained in 81 rods — times.
10. At $3 a chair, $24 will buy — chairs.

$24 will buy as many chairs as $3 is contained times in $24; $3 is contained in $24 8 times; therefore $24 will buy 8 chairs.

11. At $4 a table, $28 will buy — tables.
12. At 5¢ a spool, 40¢ will buy — spools.
13. At $7 a trunk, $56 will buy — trunks.
14. At 8¢ a slate, 72¢ will buy — slates.
15. At $9 a clock, $54 will buy — clocks.

DRY MEASURES



1. Is corn a dry substance? Name two other kinds of dry substances.
2. Why are the above called dry measures?
3. How many pints of corn will fill a quart measure?
4. What part of a quart is a pint?
5. How many quarts of oats will fill a peck measure?
6. What part of a peck is a quart?
7. How many pecks of wheat will fill a bushel measure?
8. What part of a bushel is a peck?

pk. stands for "peck" or "pecks," and bu. for "bushel" or "bushels."

Two pints equal one quart (2 pt. = 1 qt.).
Eight quarts equal one peck (8 qt. = 1 pk.).
Four pecks equal one bushel (4 pk. = 1 bu.).

9. How many pints are there in 3 quarts? in 5 qt.?
10. How many quarts are there in 2 pecks? in 7 pk.?
11. How many pecks are there in 4 bushels? in 9 bu.?
12. How many quarts are there in 8 pints? in 14 pt.?
13. How many pecks are there in 24 quarts? in 40 qt.?
14. How many bushels are there in 20 pecks? in 36 pk.?

INEXACT DIVISION

Dividing by subtracting.

1. How many 4's are there in 14?

14 − 4 = 10; 10 − 4 = 6; 6 − 4 = 2.

How many times was 4 subtracted? What is the remainder? Then complete the following:

14 contains 4 — times, with a remainder —.

2. How many are 19 − 5 − 5 − 5?

How many 5's are there, then, in 19, and how many ones over?

3. Find 21 ÷ 7 by subtraction.

21 − 7 = 14, 14 − 7 = 7, 7 − 7 = 0; 21 − three 7's = 0; 21, therefore, contains 7 three times.

4. Find 33 ÷ 6 by subtraction.

33 − 6 = 27, 27 − 6 = 21, 21 − 6 = 15, 15 − 6 = 9, 9 − 6 = 3; 33 − five 6's = 3; therefore 33 contains 6 five times with a remainder of 3; or 33 ÷ 6 = 5 and 3 over.

Find the following by subtraction:

5. 13 contains 3 — times and — over.
6. 22 contains 6 — times and — over.
7. 41 contains 7 — times and — over.
8. 38 contains 9 — times and — over.
9. 14 ÷ 5 = — and — over.
10. 37 ÷ 8 = — and — over.
11. 61 ÷ 9 = — and — over.
12. 51 ÷ 4 = — and — over.

13. 17 ÷ 2
14. 35 ÷ 6
15. 47 ÷ 8
16. 67 ÷ 7
17. 53 ÷ 9
18. 58 ÷ 7
19. 43 ÷ 5
20. 62 ÷ 8
21. 57 ÷ 6
22. 80 ÷ 9
23. 39 ÷ 4
24. 45 ÷ 7
25. $5\underline{)28}$
26. $6\underline{)43}$
27. $7\underline{)32}$
28. $5\underline{)37}$

Dividing by taking out multiples of the divisor.

1. Name the first ten multiples of 2; of 3; 4; 5; 6; 7; 8; 9.

2. Name the greatest multiple of 3 in 11; in 20; 28.

3. Name the greatest multiple of each of the numbers 4, 5, and 6 in 11; in 17; 23; 26; 33; 38; 41.

4. Name the greatest multiple of each of the numbers 7, 8, and 9 in 15; in 23; 29; 34; 39; 43; 47; 51; 57; 65.

5. Divide 37 by 8.

Think: **The greatest multiple of 8 in 37 is 32; 32 ÷ 8 = 4, and 37 – 32 = 5, and say:**

37 ÷ 8 = 4 and 5 over.

The 5 remainder is undivided. How to write the exact fractional quotient will be shown later on.

Complete:

10 = — 3's and — over
67 = — 7's and — over
33 = — 9's and — over
55 = — 6's and — over
26 = — 3's and — over

19 = — 4's + —
51 = — 8's + —
28 = — 5's + —
39 = — 7's + —
49 = — 5's + —

37 = — 5's + —
46 = — 6's + —
23 + — 4's + —
67 = — 8's + —
85 = — 9's + —

In like manner divide:

5)31
8)75
7)37
9)77
3)11
7)58
4)37

6)40
9)65
3)16
6)43
8)53
6)51
5)48

7)25
6)58
5)28
4)30
3)25
5)44
6)28

9)50
8)59
7)32
6)59
9)47
7)45
9)88

8)46
9)31
6)29
5)37
4)29
8)21
8)77

3)17
2)19
4)35
6)17
8)62
9)23
7)66

Multiply 32 by 3.

$$
\begin{array}{l}
3 \times 2 \text{ ones} = 6 \text{ ones} \\
3 \times 3 \text{ tens} = 9 \text{ tens} \\
\hline
3 \times (3 \text{ tens } 2 \text{ ones})
\end{array}
=
\begin{array}{c}
3 \text{ tens } 2 \text{ ones} \\
3 \\
\hline
9 \text{ tens } 6 \text{ ones}
\end{array}
\qquad\qquad
\begin{array}{r}
32 \\
3 \\
\hline
96
\end{array}
$$

In practice the work is done as shown on the right.

1. Multiply 13 by 2.
2. Multiply 11 by 5.
3. Multiply 12 by 4.
4. Multiply 43 by 2.
5. Multiply 33 by 3.
6. Multiply 24 by 2.
7. Multiply 41 by 2.
8. Multiply 31 by 3.
9. Multiply 14 by 2.
10. Multiply 22 by 3.
11. Multiply 21 by 3.
12. Multiply 20 by 5.

13. Divide 63 by 3.

$$
\begin{array}{l}
6 \text{ tens} \div 3 = 2 \text{ tens} \\
3 \text{ ones} \div 3 = 1 \text{ one}
\end{array}
\qquad
\begin{array}{r|l}
3 & 6 \text{ tens } 3 \text{ ones} \\
\cline{2-2}
 & 2 \text{ tens } 1 \text{ one}
\end{array}
\qquad\qquad
\begin{array}{r|l}
3 & 63 \\
\cline{2-2}
 & 21
\end{array}
$$

In practice the work is done as shown on the right.

14. Divide 42 by 2.
15. Divide 26 by 2.
16. Divide 93 by 3.
17. Divide 39 by 3.
18. Divide 64 by 2.
19. Divide 48 by 4.
20. Divide 88 by 4.
21. Divide 36 by 3.
22. Divide 96 by 3.
23. Divide 28 by 2.
24. Divide 69 by 3.
25. Divide 99 by 3.
26. Find $\frac{1}{2}$ of 64.
27. Find $\frac{1}{3}$ of 36.
28. Find $\frac{1}{4}$ of 84.
29. Find $\frac{1}{3}$ of 69.
30. If 2 books cost 84¢, how much will 1 book cost?
31. How many yards are there in 63 feet?
32. How much more is $\frac{1}{2}$ of 80 than $\frac{1}{3}$ of 99?

Multiply 23 by 4.

$$\begin{array}{r}23\\ \underline{4}\\ 92\end{array}$$

4 × 3 ones = 12 ones, or 1 ten 2 ones.
Write the 2 in the ones' place,
and carry the 1 ten.

4 × 2 tens = 8 tens. 8 tens plus the 1 ten carried = 9 tens. Write 9 in the tens' place. The product is 92.

Check. 23 + 23 + 23 + 23 = 92.

Multiply, and check by addition:

1. $\begin{array}{r}16\\ \underline{4}\end{array}$	**2.** $\begin{array}{r}39\\ \underline{2}\end{array}$	**3.** $\begin{array}{r}24\\ \underline{3}\end{array}$	**4.** $\begin{array}{r}49\\ \underline{2}\end{array}$	**5.** $\begin{array}{r}18\\ \underline{5}\end{array}$
6. $\begin{array}{r}12\\ \underline{8}\end{array}$	**7.** $\begin{array}{r}13\\ \underline{7}\end{array}$	**8.** $\begin{array}{r}45\\ \underline{2}\end{array}$	**9.** $\begin{array}{r}25\\ \underline{4}\end{array}$	**10.** $\begin{array}{r}17\\ \underline{5}\end{array}$
11. $\begin{array}{r}15\\ \underline{6}\end{array}$	**12.** $\begin{array}{r}14\\ \underline{5}\end{array}$	**13.** $\begin{array}{r}28\\ \underline{3}\end{array}$	**14.** $\begin{array}{r}19\\ \underline{4}\end{array}$	**15.** $\begin{array}{r}27\\ \underline{3}\end{array}$

16. Find the cost of 3 chickens at 25¢ each.

17. If 1 yard of cloth costs 15¢, how much will 6 yards cost?

18. There are 12 inches in a foot. How many inches are there in 7 feet?

19. If Henry walks 18 miles a day, how many miles will he walk in 5 days?

20. Annie read 19 pages, and Minnie read 3 times as many as Annie. How many pages did Minnie read?

21. A man bought 6 squirrels and paid 14¢ apiece for them. How much did he pay for all the squirrels?

22. How many feet are there in 29 yards?

23. How many pecks are there in 23 bushels?

Divide 78 by 3.

$$3\overline{)6\text{ tens }18\text{ ones}} \qquad\qquad 3\overline{)78}$$
$$\;\;2\text{ tens }\;6\text{ ones} \qquad\qquad\quad 26$$

7 tens ÷ 3 = 2 tens and 1 ten undivided; write 2 in the tens' place of the quotient.

1 ten and 8 ones = 18 ones; 18 ones ÷ 3 = 6 ones; write 6 in the ones' place of the quotient. The quotient is 26.

In practice the work is done as shown on the right.

Exercises (Written)

1. Divide 38 by 2.
2. Divide 54 by 2.
3. Divide 45 by 3.
4. Divide 81 by 3.
5. Divide 72 by 3.
6. Divide 56 by 4.
7. Divide 72 by 3.
8. Divide 92 by 4.
9. Divide 95 by 5.
10. Divide 90 by 6.
11. Divide 84 by 7.
12. Divide 98 by 7.

13. How many months will it take Henry to gain $96, if he gains $4 a month?

14. John gathered 78 walnuts, and divided them equally among his 6 sisters. How many walnuts did each girl receive?

15. If chairs cost $5 a dozen, how many dozen can be bought for $85?

16. Seven boys bought a foot-ball for 91¢, and agreed to pay equally. How much should each pay?

17. How many 7's are there in 98? 96 ÷ 6 = —.

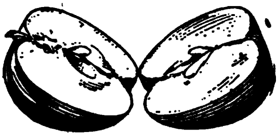
18. How many pecks are there in 96 quarts?

19. How many yards are there in 84 feet?

20. A man paid $80 for 5 suits of clothes. Find the average cost per suit.

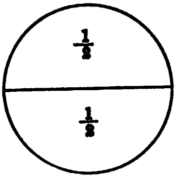
HALVES

One (1)



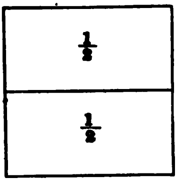
Halves ($\frac{1}{2}$'s)

One (1)



Halves ($\frac{1}{2}$'s)

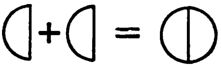
One (1)

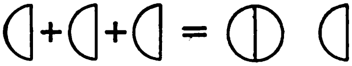


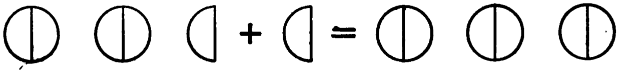
Halves ($\frac{1}{2}$'s)

How many halves of an apple are there in 1 apple? How many halves of a circle equal a whole circle? How many half dollars are there in \$1? How many $\frac{1}{2}$'s are there in 1? $\frac{1}{2}+\frac{1}{2}=?$

Write the following in figures:

1. 

2. 

3. 

4. Make like pictures for $2\frac{1}{2}+3\frac{1}{2}=6$; $4\frac{1}{2}+\frac{1}{2}=5$; $\frac{1}{2}+2\frac{1}{2}=3$. $2-\frac{1}{2}=1\frac{1}{2}$; $4-1\frac{1}{2}=2\frac{1}{2}$.

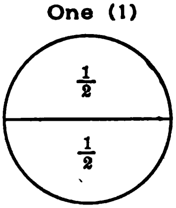
Add:

5.	6.	7.	8.	9.	10.
$\$3\frac{1}{2}$	$\$5$	$2\frac{1}{2}$	8	$3\frac{1}{2}$	$6\frac{1}{2}$
$\$6$	$\$7\frac{1}{2}$	4	$9\frac{1}{2}$	$8\frac{1}{2}$	$\frac{1}{2}$
$\$2\frac{1}{2}$	$\$8$	$\frac{1}{2}$	$7\frac{1}{2}$	9	$7\frac{1}{2}$
$\$1$	$\$2$	$3\frac{1}{2}$	$\frac{1}{2}$	5	$2\frac{1}{2}$

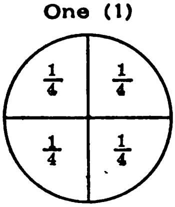
Subtract:

11.	12.	13.	14.	15.	16.
$\$8\frac{1}{2}$	$\$5\frac{1}{2}$	9	13	$20\frac{1}{2}$	30
$\$\ \frac{1}{2}$	$\$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	7	$9\frac{1}{2}$

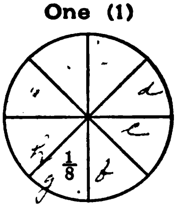
HALVES, FOURTHS, AND EIGHTHS



Halves ($\frac{1}{2}$'s)

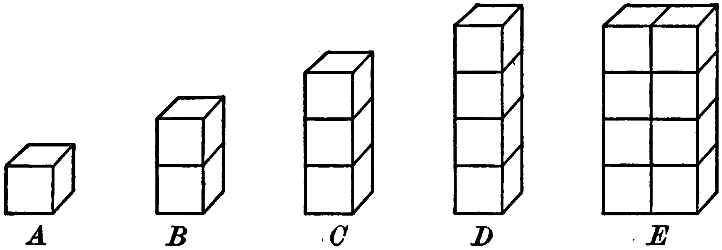


Fourths ($\frac{1}{4}$'s)



Eighths ($\frac{1}{8}$'s)

1. How many $\frac{1}{2}$'s are there in 1?
2. How many $\frac{1}{4}$'s are there in 1? in $\frac{1}{2}$?
3. How many $\frac{1}{8}$'s are there in 1? in $\frac{1}{2}$? in $\frac{1}{4}$?
4. Compare $\frac{2}{4}$ and $\frac{1}{2}$.
5. Which is more, $\frac{2}{4}$ of a dollar or $\frac{1}{2}$ of a dollar?
6. In the second circle point out $\frac{3}{4}$ of the circle.
7. How many times as great as $\frac{1}{4}$ is $\frac{3}{4}$?
8. How much is $3 \times \frac{1}{4}$?
9. In the third circle point out the following **parts of** the circle: $\frac{1}{2}$; $\frac{1}{4}$; $\frac{3}{4}$; $\frac{1}{8}$; $\frac{2}{8}$; $\frac{3}{8}$; $\frac{4}{8}$; $\frac{5}{8}$; $\frac{6}{8}$; $\frac{7}{8}$.
10. Compare $\frac{2}{8}$ and $\frac{1}{4}$; $\frac{4}{8}$ and $\frac{1}{2}$; $\frac{6}{8}$ and $\frac{3}{4}$.
11. Express $\frac{2}{8}$ in fourths; $\frac{6}{8}$ in fourths.
12. Express $\frac{4}{8}$ in fourths; in halves.
13. Express $\frac{1}{2} + \frac{1}{4}$ in fourths; in eighths.
14. Express $\frac{1}{2} + \frac{3}{4}$ in fourths; in eighths.
15. Express $\frac{1}{2} + \frac{2}{4} + \frac{3}{8}$ in eighths.
16. Change $\frac{2}{4}$ to halves; to 8ths.
17. Express "$\frac{2}{4}$ of a yard" in the simplest way.
18. Express "$\frac{6}{8}$ of a year" in the simplest way.
19. How much, in the simplest form, is $\frac{5}{8} + \frac{1}{8}$? $\frac{7}{8} - \frac{3}{8}$?



1. If A is a pint measure, what measure is B? E?

2. What part of B is A? of 1 qt. is 1 pt.?

3. What part of D is A? What part is B? C?

4. What part, then, of 4 pt. is 1 pt.? What part is 1 qt.? 3 pt.?

5. What part of E is A? What part is B? C? D?

6. What part, then, of 1 gal. is 1 pt.? is 1 qt. or 2 pt.? 3 pt.? 4 pt. or 2 qt.?

7. If B is the **unit** or 1, then A is $\frac{1}{2}$.

8. If D is the unit or 1, what is A? B? C?

9. If E is the unit or 1, what is A? B? C? D?

A **fraction** is a part of a unit, like $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{8}$.

The **denominator** is the number below the line.

The **numerator** is the number above the line.

10. Pints, quarts, and gallons may be represented by numbers or fractions.

Thus, if 1 stands for D, then $\frac{1}{4}$ will stand for A, $\frac{2}{4}$ or $\frac{1}{2}$ for B, $\frac{3}{4}$ or $3 \times \frac{1}{4}$ for C, and 2 for E.

11. What numbers or fractions will stand for A, B, C, D, E when 1 stands for A? for B? D? E?

12. Express 1 pt. + 1 qt. + 1 gal. in fractions, taking a gallon for the unit or 1.

The denominator **names** the part into which the unit or 1 is divided. The numerator shows **how many parts are taken.**

Thus, $\frac{3}{4}$ and $\frac{5}{8}$ mean, and are read, 3 fourths and 5 eighths.

The part name of $\frac{1}{2}$ is half; of $\frac{3}{8}$, eighth.

1. Have $\frac{1}{4}$ and $\frac{3}{4}$ the same part name?

2. Have $\frac{1}{2}$ and $\frac{5}{8}$ the same part name?

3. Have 3 days and 2 days the same name? What is their sum?

4. How much is 2 halves or $\frac{2}{2}$? 4 fourths or $\frac{4}{4}$? $\frac{8}{8}$?

5. Find 1 half + 1 half. Then $\frac{1}{2}+\frac{1}{2}=$?

Always give the answer in its simplest form.

6. Find 1 fourth + 1 fourth. Then $\frac{1}{4}+\frac{1}{4}=$?

7. Find 3 eighths − 1 eighth. Then $\frac{3}{8}-\frac{1}{8}=$?

8. Find 5 eighths + 1 eighth. Then $\frac{5}{8}+\frac{1}{8}=$?

9. Find 7 eighths − 3 eighths. Then $\frac{7}{8}-\frac{3}{8}=$?

10. Find $\frac{1}{4}+\frac{3}{4}$; $\frac{1}{8}+\frac{2}{8}+\frac{5}{8}$.

11. How are two fractions added when they have the same part name or denominator?

12. How are two such fractions subtracted?

13. Can 3 days and 2 yards be added? Why not?

14. Can 3 qt. and 2 gal. be added as they stand? Can 2 gal. be changed to quarts? How many quarts equal 2 gal.? How many quarts, then, equal 3 qt. + 2 gal.?

15. Can $\frac{1}{2}$ and $\frac{1}{4}$ be added as they stand? Why not?

16. Can $\frac{1}{2}$ be changed to fourths? How many fourths equal a half? How many fourths, then, equal $\frac{1}{2}+\frac{1}{4}$?

17. Express $\frac{1}{2}$ in 4ths; in 8ths.

18. Express $\frac{1}{4}$, $\frac{2}{4}$, and $\frac{3}{4}$ in 8ths.

Find $\frac{1}{2}+\frac{1}{4}$; find $\frac{1}{2}-\frac{1}{4}$.

Change $\frac{1}{2}$ to $\frac{2}{4}$, then

$\frac{1}{2}+\frac{1}{4}=\frac{2}{4}+\frac{1}{4}=\frac{3}{4}$; and $\frac{1}{2}-\frac{1}{4}=\frac{2}{4}-\frac{1}{4}=\frac{1}{4}$.

Find $\frac{1}{2}+\frac{1}{4}+\frac{3}{8}$.

Change $\frac{1}{2}$ and $\frac{1}{4}$ to eighths. Thus,

$\frac{1}{2}=\frac{4}{8}$, $\frac{1}{4}=\frac{2}{8}$. Then, $\frac{4}{8}+\frac{2}{8}+\frac{3}{8}=\frac{9}{8}=1\frac{1}{8}$.

Add:

1. $\$\frac{1}{2}$	*2.* $\frac{3}{4}$	*3.* $2\frac{1}{8}$	*4.* $7\frac{3}{8}$	*5.* $6\frac{1}{2}$	*6.* $3\frac{5}{8}$
$\underline{\$\frac{1}{4}}$	$\underline{\frac{1}{2}}$	$\underline{1\frac{1}{4}}$	$\underline{2\frac{5}{8}}$	$\underline{4\frac{3}{8}}$	$\underline{1\frac{1}{4}}$

Subtract:

7. $\$\frac{1}{2}$	*8.* $\frac{3}{4}$	*9.* $5\frac{1}{2}$	*10.* $6\frac{3}{4}$	*11.* $7\frac{7}{8}$	*12.* $9\frac{5}{8}$
$\underline{\$\frac{1}{4}}$	$\underline{\frac{1}{2}}$	$\underline{2\frac{1}{8}}$	$\underline{5\frac{1}{8}}$	$\underline{4\frac{1}{2}}$	$\underline{3\frac{1}{4}}$

13. One fish weighs $2\frac{1}{2}$ pounds and another $1\frac{1}{4}$ pounds. How much do both together weigh?

14. John jumped $8\frac{3}{4}$ feet and William $7\frac{1}{2}$ feet. How much did John beat William?

15. One cow gave $1\frac{5}{8}$ gal. of milk and another $2\frac{1}{2}$ gal. How much milk did both cows give?

16. There are $6\frac{1}{2}$ bu. of corn in a box. If $3\frac{1}{8}$ bu. are taken out, how much will be left?

17. If you buy a hat for $\$2\frac{1}{4}$, a coat for $\$5\frac{1}{2}$, a knife for $\$\frac{3}{4}$, and hand the clerk a 10-dollar bill, how much change should he give you?

18. From a barrel containing $25\frac{1}{2}$ lb. of sugar a grocer sold to one lady $12\frac{3}{4}$ lb. and to another $9\frac{5}{8}$ lb. How many pounds were left in the barrel?

Find $\frac{3}{4}$ of 20.

$\frac{3}{4}$ of 20 means $3 \times \frac{1}{4}$ of $20 = 3 \times 5 = 15$.

Find $\frac{5}{8}$ of 48.

$\frac{5}{8}$ of 48 means $5 \times \frac{1}{8}$ of $48 = 5 \times 6 = 30$.

Find:

1. $\frac{1}{2}$ of 6
2. $\frac{3}{8}$ of 40
3. $\frac{3}{4}$ of 24 yards
4. $\frac{3}{4}$ of 8
5. $\frac{5}{8}$ of 56
6. $\frac{7}{8}$ of 40 birds

7. If a pound of butter is worth 32 cents, how much is $\frac{3}{4}$ of a pound worth?

8. Bob's age is 16 years, and Ben's age is $\frac{5}{8}$ as much. How old is Ben?

9. Find $5\frac{3}{4} \times 8$.

$5\frac{3}{4} \times 8$ means $5 \times 8 + \frac{3}{4}$ of $8 = 40 + 6 = 46$.

Find:

10. $2\frac{1}{2} \times \$6$
11. $4\frac{1}{2} \times 12$
12. $2\frac{3}{8} \times 16$
13. $1\frac{1}{4} \times \$8$
14. $2\frac{3}{4} \times 20$
15. $1\frac{5}{8} \times 40$
16. $3\frac{3}{4} \times \$4$
17. $3\frac{1}{8} \times 16$
18. $3\frac{7}{8} \times 24$

19. Find the cost of $3\frac{1}{2}$ yd. of cloth at 10¢ a yard.

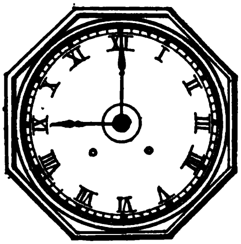
20. Find the cost of $2\frac{3}{4}$ lb. of cheese at 20¢ a pound.

21. Ella bought $5\frac{1}{4}$ yd. of ribbon at 12¢ a yard. How much did it cost her?

22. A boy worked $6\frac{3}{4}$ hours at 8¢ an hour. How much did he earn?

23. A boy sold $2\frac{3}{8}$ pk. of berries at 5¢ a quart. How much did he receive for them?

MEASURING TIME



1. On the face of a clock what letter or letters stand for 1? for 2? 3? 4? 5? 6? 7? 8? 9? 10? 11? 12?

The **hour hand** is the short hand.

The **minute hand** is the long hand.

The **minute spaces** are the little spaces marked on the rim just outside the letters.

2. How many minute spaces are there? Count them by 5's, calling 5 at I, 10 at II, and so on.

A **minute** is the time it takes the long hand to go one minute space, and an **hour** is the time it takes the long hand to go around, from XII back to XII. While the long hand is going around, the short hand goes 5 minute spaces, or from XII to I.

3. What time is it by the clock above? When the minute hand has moved to I, it will be 5 minutes past 9 or 9:05 (nine-five); when it has moved to II, it will be 10 minutes past 9 or 9:10; when it has moved to III, it will be 15 minutes past 9, a quarter past 9, or 9:15, and so on. The time 9:30 is halfpast nine and 9:45 is a quarter to ten.

4. What time is it when the hour hand is between IV and V, and the minute hand is at the 18th minute space?

5. Tell where the hands are when the time of day is 5; 5:20; 7; 7:35; 8; 8:45; 10:55.

60 minutes equal an hour (60 min. = 1 hr.).
24 hours equal a day (24 hr. = 1 da.).

The day always begins at XII, midnight.

Forenoon is the 12 hours from midnight to noon.

Afternoon is the 12 hours from noon to midnight.

A.M. stands for forenoon, and P.M. for afternoon.

Thus, 5:40 A.M. is read 40 minutes past 5 in the morning.

1. Read 6:37 A.M.; 7 P.M.; 8:25 A.M.; 9:10 P.M.; 2:55 A.M.; 3:58 P.M.; 11 A.M.; 4:03 P.M.

2. How many hours is it from 7 A.M. to 11 A.M.? from 10 P.M. to 4 A.M.? from 4 A.M. to 4 P.M.?

3. How much longer is it from 5 A.M. to 7 P.M. than it is from 7 A.M. to 5 P.M.?

4. How many days is it from 9 A.M. Sunday to 9 A.M. the following Sunday?

7 days equal a week (7 da. = 1 wk.).

5. Name the months of the year.

12 months equal a year (12 mo. = 1 yr.).

6. How many months are there in 5 years? in $3\frac{1}{2}$ years? in $2\frac{3}{4}$ years?

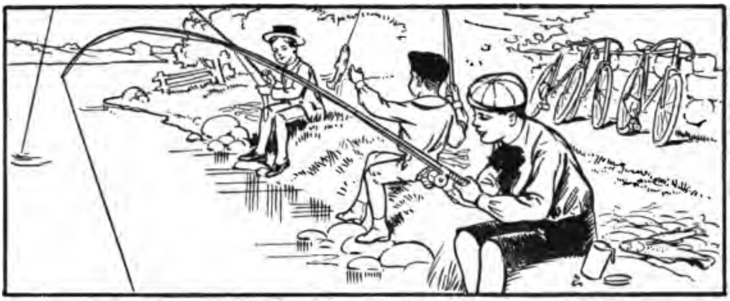
7. How many days are there in 9 weeks?

8. How many hours are there in 3 days? in $3\frac{1}{2}$ days? in $\frac{3}{4}$ of a day? in $\frac{5}{8}$ of a day?

9. How many minutes are there in $1\frac{1}{2}$ hours? in $\frac{3}{4}$ of an hour? in $1\frac{1}{4}$ hours?

10. What part of a year is 6 months? 9 months?

11. How many minutes did a boy work who began at 10:35 A.M. and quit at 11:50 A.M.?



1. Frank caught 27 fish, George caught 34 fish, and Henry caught 26 fish. How many fish did all together catch?

2. How many did they catch on an average apiece?

3. How many did George lack of catching as many as Frank and Henry together?

4. Of the fish caught, 9 were catfish, 10 were trout, and the rest perch. How many perch were there?

5. All the trout they caught weighed 6½ lb., all the catfish 1¾ lb., and all the perch 3 lb. How much did the entire catch weigh?

6. How much would the boys receive for the catch if they sold it at 8¢ a pound?

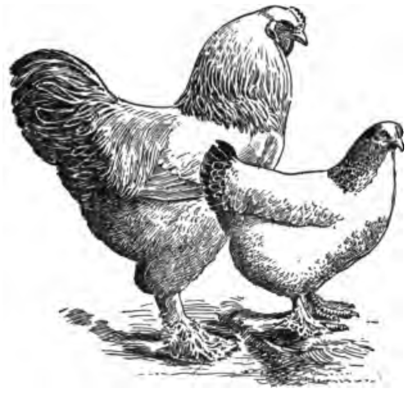
7. How much more did the trout weigh than the catfish and perch together?

8. The boys began fishing at 7:35 A.M. and quit at 11:15 A.M. How many hours and minutes did they fish?

9. Frank weighs 88½ lb., Henry weighs 1¾ lb. more than Frank, and George weighs 3⅝ lb. more than Henry. Find the weights of Henry and George.

10. The boys went home on their bicycles in ¾ of an hour at the rate of 8 miles an hour. How far were they from home?

Standard weights of some fine chickens.



Light Brahmas

The numbers give the weights in pounds, the first for males and the second for females.

	M.	F.
Light Brahma	12,	9½
Dark Brahma	11,	8½
Langshans	10,	7
Plymouth Rock	9½,	7½
Javas	9½,	7½
Dominiques	8½,	6½
Wyandottes	8½,	6½
White Dorkins	7½,	6

A pair of any kind means a male and a female of that kind.

1. Find the weight of a pair of Plymouth Rocks.

2. How much more does a pair of Langshans weigh than a pair of White Dorkins?

3. How much more would a pair of Dark Brahmas cost than a pair of Dominiques at 18 ¢ a pound?

4. A lady paid $9½ for a pair of Light Brahmas and $7¼ for a pair of White Dorkins. How much more did the Brahmas cost than the Dorkins?

5. Find the cost of a Java hen at 12 ¢ a pound.

6. Find the cost of ⅓ of a dozen broilers, having an average weight of 1½ pounds, at 14 ¢ a pound.

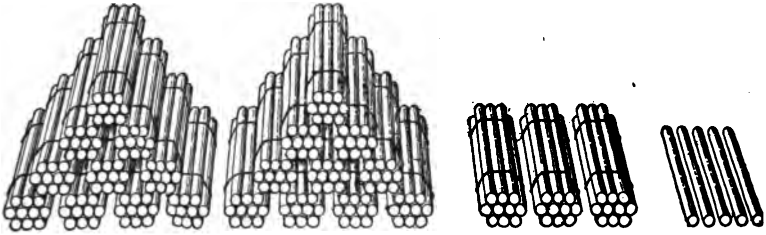
7. If eggs are worth 36 ¢ a dozen, how much will 2¼ dozen cost?

8. Find the weight of all the males in the above list.

9. Find how much more all the males together weigh than all the females.

V. HUNDREDS, TENS, AND ONES — FROM 1 TO 1000

NOTATION AND NUMERATION



2 hundreds 3 tens 5 ones is written 235, and read two hundred thirty-five.

5 hundreds 0 tens 6 ones is written 506, and read 5 hundred six.

7 hundreds 4 tens 0 ones is written 740, and read seven hundred forty.

Complete:

1. 2 hundreds 0 tens 1 one is 201, read, two hundred one.
2. 1 hundred 5 tens 0 ones is —, read, — — —.
3. 3 hundreds 0 tens 0 ones is —, read, — — —.
4. 6 hundreds 8 tens 2 ones is —, read, — — —.
5. 5 hundreds 1 ten 1 one is —, read, — — —.
6. 7 hundreds 1 ten 9 ones is —, read, — — —.
7. 4 hundreds 2 tens 3 ones is —, read, — — —.
8. 9 hundreds 9 tens 9 ones is —, read, — — —.

When a number is expressed by three figures, the first figure, counting from the right, denotes ones, the second tens, and the third hundreds.

Express by words:

1. 107 **2.** 538 **3.** 297 **4.** 580 **5.** 777

6. 801 **7.** 756 **8.** 627 **9.** 260 **10.** 579

11. 180 **12.** 403 **13.** 865 **14.** 921 **15.** 354

16. 412 **17.** 131 **18.** 501 **19.** 494 **20.** 330

21. 945 **22.** 813 **23.** 716 **24.** 111 **25.** 999

26. 700 **27.** 290 **28.** 555 **29.** 222 **30.** 888

Express by figures:

31. Two hundred **32.** Two hundred seven

33. Six hundred **34.** Six hundred eight

35. Five hundred **36.** Four hundred nine

37. Nine hundred **38.** Five hundred four

39. Four hundred **40.** Nine hundred five

41. Three hundred **42.** Seven hundred one

43. Eight hundred **44.** Three hundred two

45. Seven hundred **46.** Eight hundred one

47. Eight hundred seventeen

48. Two hundred seventy-one

49. Six hundred ninety-four

50. Nine hundred sixty-nine

51. Five hundred thirty-two

52. Four hundred forty-four

53. Seven hundred sixty-one

54. Three hundred fifty-four

The greatest number that can be expressed by three figures is 999, or nine hundred ninety-nine. 999 and 1 is a thousand, which is expressed by figures thus, 1000. One thousand is 10 hundred.

REVIEW

First add; then subtract:

1. 47	**2.** 67	**3.** 76	**4.** 50	**5.** 57
22	28	17	36	29
6. $8\frac{1}{2}$	**7.** $9\frac{1}{2}$	**8.** $12\frac{1}{4}$	**9.** $40\frac{3}{8}$	**10.** $56\frac{3}{4}$
7	$3\frac{1}{4}$	$8\frac{1}{8}$	$17\frac{1}{4}$	$28\frac{5}{8}$

Multiply:

11. 18	**12.** 16	**13.** 29	**14.** 18	**15.** 13
4	6	3	5	7

Divide:

16. $4\overline{)96}$	**17.** $5\overline{)85}$	**18.** $7\overline{)98}$	**19.** $6\overline{)84}$

Find:

20. $\frac{1}{4}$ of 36	**21.** $\frac{3}{8}$ of 48	**22.** $\frac{3}{4}$ of 56	**23.** $\frac{5}{8}$ of 72
24. $2\frac{1}{2} \times 18$	**25.** $5\frac{3}{4} \times 16$	**26.** $3\frac{1}{8} \times 24$	**27.** $2\frac{3}{8} \times 32$

28. Find 4 times $3\frac{1}{2}$ by addition. Find $3\frac{1}{2}$ times 4 by multiplication. Does $4 \times 3\frac{1}{2} = 3\frac{1}{2} \times 4$?

29. Find the cost of sending a 17-word telegram from New Orleans to Atlanta, at a day rate. (See p. 81.)

30. At 5¢ an orange, how many oranges can I buy for 85¢?

31. How many pecks are there in 19 bushels?

32. How many pecks are there in 96 quarts?

33. How far will a man travel in $2\frac{3}{4}$ hours at the rate of 24 miles an hour?

34. How many hours is it from 4 A.M. to 9 P.M.?

35. How many minutes is it from 8:25 A.M. to 9:50 A.M.?

36. Make an application, each, of examples 2, 7, 12, 17, 21, and 25.

ADDITION

Find the sum of 365, 233, and 39.

9 ones + 3 ones + 5 ones = 17 ones, or 1 ten 7 ones. Write 7 in the ones' place below, and carry the 1 ten.

1 ten (carried) + 3 tens + 3 tens + 6 tens = 13 tens, or 1 hundred 3 tens. Write 3 in the tens' place below, and carry the 1 hundred.

1 hundred (carried) + 2 hundreds + 3 hundreds = 6 hundreds. Write 6 in the hundreds' place below.

Check. Begin at the top and add downward.

$$\begin{array}{r}365\\233\\39\\\hline 637\end{array}$$

Add:

1.	**2.**	**3.**	**4.**	**5.**
123	129	642	375	235
417	350	137	281	143
372	468	145	79	594

6.	**7.**	**8.**	**9.**	**10.**
235	156	247	318	245
171	283	138	237	307
68	142	265	129	97
44	86	199	198	216

11.	**12.**	**13.**	**14.**	**15.**
38	45	267	307	413
43	96	148	214	105
78	87	75	100	67
125	248	69	84	84
134	305	38	96	249

16. Find 125 + 32 + 208 + 84 + 17 + 268.

17. Find 62 + 195 + 73 + 205 + 42 + 306.

18. Find, without counting all the squares, the number of squares in the two oblongs together on page 78.

1. In one box there are 144 lemons, in another 185, and in a third 216. How many lemons are there in all?

2. If Charles reads 162 pages the first week, 289 pages the second week, and 396 pages the third week, how many pages will he read in the three weeks?

3. A man paid $375 for a pair of horses, $250 for a surry, and $48 for two sets of harness. How much did the outfit cost him?

4. A farmer sold two bales of cotton weighing, respectively, 496 pounds and 487 pounds. How many pounds did he sell?

5. If a man earns in four months, respectively, $156, $218, $47, $309, how much does he earn in all?

6. A postman delivered 196 letters on Monday, 225 on Tuesday, 218 on Wednesday, and 309 on Thursday. How many letters did he deliver in the four days?

7. A lady bought a sofa for $54, a set of chairs for $38, a set of china for $125, and a piano for $560. How much did she spend?

8. Henry counted the cars in six trains. There were 24, 29, 33, 36, 42, and 48. How many cars were there in all?

9. In one day George picked 94 pounds of cotton, Bob 87 pounds, Jack 103 pounds, Ben 98 pounds, and Moses 117 pounds. How many pounds were picked by all?

10. A lady bought 9 chickens at 35 ¢ each, and 7 dozen eggs at 27 ¢ a dozen. How much did she spend?

11. Dora weighs $102\frac{1}{2}$ lb., Ethel $127\frac{3}{4}$ lb., George $65\frac{1}{2}$ lb., and Frank $119\frac{1}{8}$ lb. How much do they weigh all together?

SUBTRACTION

Subtract:

1. $\begin{array}{r}75\\ \underline{48}\end{array}$ **2.** $\begin{array}{r}63\\ \underline{27}\end{array}$ **3.** $\begin{array}{r}36\\ \underline{19}\end{array}$ **4.** $\begin{array}{r}45\\ \underline{28}\end{array}$ **5.** $\begin{array}{r}90\\ \underline{43}\end{array}$ **6.** $\begin{array}{r}84\\ \underline{35}\end{array}$ **7.** $\begin{array}{r}57\\ \underline{28}\end{array}$

8. $\begin{array}{r}64\\ \underline{19}\end{array}$ **9.** $\begin{array}{r}41\\ \underline{18}\end{array}$ **10.** $\begin{array}{r}54\\ \underline{27}\end{array}$ **11.** $\begin{array}{r}86\\ \underline{39}\end{array}$ **12.** $\begin{array}{r}97\\ \underline{48}\end{array}$ **13.** $\begin{array}{r}43\\ \underline{38}\end{array}$ **14.** $\begin{array}{r}30\\ \underline{18}\end{array}$

15. $\begin{array}{r}41\\ \underline{18}\end{array}$ **16.** $\begin{array}{r}58\\ \underline{49}\end{array}$ **17.** $\begin{array}{r}64\\ \underline{35}\end{array}$ **18.** $\begin{array}{r}67\\ \underline{19}\end{array}$ **19.** $\begin{array}{r}54\\ \underline{47}\end{array}$ **20.** $\begin{array}{r}28\\ \underline{19}\end{array}$ **21.** $\begin{array}{r}95\\ \underline{76}\end{array}$

22. From 637 subtract 285.

$$\begin{array}{r}\scriptstyle 5\,13\\ 637\\ \underline{285}\\ 352\end{array}$$

5 ones from 7 ones leaves 2 ones. As 8 tens cannot be taken from 3 tens, take 1 hundred (or 10 tens) from the 6 hundreds, and add it (10 tens) to the 3 tens, making 13 tens. Then, 8 tens from 13 tens leaves 5 tens, and 2 hundreds from 5 hundreds leaves 3 hundreds.

352 is the difference.

Check. $352 + 285 = 637$.

Subtract and check:

23. $\begin{array}{r}483\\ \underline{259}\end{array}$ **24.** $\begin{array}{r}564\\ \underline{337}\end{array}$ **25.** $\begin{array}{r}392\\ \underline{108}\end{array}$ **26.** $\begin{array}{r}881\\ \underline{275}\end{array}$ **27.** $\begin{array}{r}543\\ \underline{28}\end{array}$ **28.** $\begin{array}{r}654\\ \underline{39}\end{array}$

29. $\begin{array}{r}432\\ \underline{257}\end{array}$ **30.** $\begin{array}{r}751\\ \underline{368}\end{array}$ **31.** $\begin{array}{r}647\\ \underline{589}\end{array}$ **32.** $\begin{array}{r}733\\ \underline{377}\end{array}$ **33.** $\begin{array}{r}825\\ \underline{799}\end{array}$ **34.** $\begin{array}{r}964\\ \underline{288}\end{array}$

35. $\begin{array}{r}503\\ \underline{221}\end{array}$ **36.** $\begin{array}{r}605\\ \underline{334}\end{array}$ **37.** $\begin{array}{r}804\\ \underline{503}\end{array}$ **38.** $\begin{array}{r}307\\ \underline{256}\end{array}$ **39.** $\begin{array}{r}902\\ \underline{581}\end{array}$ **40.** $\begin{array}{r}801\\ \underline{391}\end{array}$

41. $\begin{array}{r}802\\ \underline{237}\end{array}$ **42.** $\begin{array}{r}601\\ \underline{429}\end{array}$ **43.** $\begin{array}{r}403\\ \underline{198}\end{array}$ **44.** $\begin{array}{r}205\\ \underline{97}\end{array}$ **45.** $\begin{array}{r}407\\ \underline{249}\end{array}$ **46.** $\begin{array}{r}706\\ \underline{368}\end{array}$

1. One bale of cotton weighs 516 pounds and another 498 pounds. Find the difference between their weights.

2. In selling a town lot for $915, the owner gained $167. How much did the lot cost him?

3. A farmer raised 840 bushels of corn and sold 354 bushels. How many bushels had he left?

4. A clerk's salary is $775 a year. If his expenses are $387, how much can he save in a year?

5. A man has $500. If he pays $184 for a horse and $75 for a buggy, how much will he have left?

6. Mr. Saxon has $465. If he sells a lot for $516 and pays $325 for a horse and buggy, how much money will he then have?

7. A, B, and C are three towns on the same road, and B lies between A and C. It is 217 miles from A to B, and 402 miles from A to C. How far is it from B to C?

8. Mr. Jordan bought a house for $684 and sold it for $800. Did he gain or lose? How much?

9. A man bought 3 acres of land for $125, and sold it at $29 an acre. Did he gain or lose? How much?

10. A dealer bought 38 chickens at 18 cents apiece and sold them at 25 cents apiece. How much did he gain on each chicken? On all the chickens?

11. A father weighs 187½ lb., and his son 68¼ lb. How much more does the father weigh than the son?

12. Miss Jones bought 68 yd. of lace at 7¼¢ a yard, and 42 yd. of ribbon at 8½¢ a yard. How much more did the lace cost than the ribbon?

13. Find the difference between 805 and 527.

MULTIPLICATION

Find the following by addition and by multiplication:

1. $\begin{array}{r}6\\6\\6\\\underline{6}\end{array}$	**2.** $\begin{array}{r}7\\7\\7\\\underline{7}\end{array}$	**3.** $\begin{array}{r}13\\13\\13\\\underline{13}\end{array}$	**4.** $\begin{array}{r}18\\18\\18\\\underline{18}\end{array}$	**5.** $\begin{array}{r}24\\24\\24\\\underline{24}\end{array}$

6. Find $47 + 47 + 47 + 47 + 47$ by multiplication.

The sum is equal to 5×47.
5×7 ones are 35 ones, or 3 tens 5 ones.
Write 5 in the ones' place, and carry the 3 tens.
5×4 tens are 20 tens; 20 tens + 3 tens (carried) are 23 tens, or 2 hundred 3 tens.
Write 3 in the tens' place and 2 in the hundreds' place.
The product is 235.
Prove or check the work by addition.

$$\begin{array}{r}47\\\underline{5}\\235\end{array}$$

Multiply and check:

7. $\begin{array}{r}34\\\underline{3}\end{array}$	**8.** $\begin{array}{r}43\\\underline{6}\end{array}$	**9.** $\begin{array}{r}56\\\underline{4}\end{array}$	**10.** $\begin{array}{r}68\\\underline{5}\end{array}$	**11.** $\begin{array}{r}75\\\underline{8}\end{array}$
12. $\begin{array}{r}82\\\underline{7}\end{array}$	**13.** $\begin{array}{r}57\\\underline{9}\end{array}$	**14.** $\begin{array}{r}78\\\underline{6}\end{array}$	**15.** $\begin{array}{r}39\\\underline{7}\end{array}$	**16.** $\begin{array}{r}84\\\underline{8}\end{array}$
17. $\begin{array}{r}49\\\underline{3}\end{array}$	**18.** $\begin{array}{r}76\\\underline{4}\end{array}$	**19.** $\begin{array}{r}98\\\underline{5}\end{array}$	**20.** $\begin{array}{r}72\\\underline{6}\end{array}$	**21.** $\begin{array}{r}86\\\underline{9}\end{array}$
22. $\begin{array}{r}93\\\underline{8}\end{array}$	**23.** $\begin{array}{r}79\\\underline{4}\end{array}$	**24.** $\begin{array}{r}58\\\underline{6}\end{array}$	**25.** $\begin{array}{r}63\\\underline{7}\end{array}$	**26.** $\begin{array}{r}99\\\underline{9}\end{array}$

27. $74 \times 5\frac{1}{2}$ **28.** $36 \times 8\frac{1}{4}$ **29.** $96 \times 7\frac{3}{4}$

Multiply 263 by 3.

3 × 3 ones are 9 ones. Write 9 below.

3 × 6 tens are 18 tens, or 1 hundred 8 tens. Write 8 below, and carry the 1 hundred.

3 × 2 hundreds plus 1 hundred (carried) are 7 hundreds. Write 7 below.

The product is 789.

Proof or Check. 263 + 263 + 263 = 789.

$$\begin{array}{r}263\\ \underline{3}\\ 789\end{array}$$

Multiply and check:

$$\textbf{1.}\ \begin{array}{r}473\\ \underline{2}\end{array}\qquad \textbf{2.}\ \begin{array}{r}327\\ \underline{3}\end{array}\qquad \textbf{3.}\ \begin{array}{r}248\\ \underline{4}\end{array}\qquad \textbf{4.}\ \begin{array}{r}189\\ \underline{5}\end{array}$$

$$\textbf{5.}\ \begin{array}{r}164\\ \underline{6}\end{array}\qquad \textbf{6.}\ \begin{array}{r}128\\ \underline{7}\end{array}\qquad \textbf{7.}\ \begin{array}{r}119\\ \underline{8}\end{array}\qquad \textbf{8.}\ \begin{array}{r}106\\ \underline{9}\end{array}$$

9. Ella's book has 156 pages, Jane's 156 pages, and Mary's 156. How many pages are there in all?

10. A barrel of flour weighs 196 pounds. How much do 4 barrels of flour weigh?

A man went into a store with a 5-dollar bill (= 500 ¢). How much change would he get if he gave the bill in payment:

11. For 3 pounds of tea at 65 ¢ a pound?

12. For 8 pounds of butter at 32 ¢ a pound?

13. For 6 dozen apples at 25 ¢ a dozen?

14. For 9 dozen eggs at 35 ¢ a dozen?

15. For 7 pounds of cheese at 18 ¢ a pound?

16. Alice bought 108 valentines for her party at $7\frac{1}{2}$ ¢ each. How much did they cost?

DIVISION

1. Divide 18 by 6. **2.** Divide 54 by 9.
3. Divide 40 by 8. **4.** Divide 63 by 7.
5. Divide 68 by 2. **6.** Divide 93 by 3.
7. Divide 72 by 4. **8.** Divide 84 by 6.
9. Divide 95 by 5. **10.** Divide 98 by 7.

11. Divide 369 by 3.

$$\begin{array}{r} 3\overline{)\text{3 hundreds 6 tens 9 ones}} \\ \text{1 hundred 2 tens 3 ones} \end{array} \qquad \begin{array}{r} 3\overline{)369} \\ 123 \end{array}$$

Find:

12. 482 ÷ 2 **13.** 426 ÷ 2 **14.** 609 ÷ 3
15. 969 ÷ 3 **16.** 840 ÷ 4 **17.** 408 ÷ 4

18. 744 ÷ 3

$$\begin{array}{r} 3\overline{)744} \\ 248 \end{array}$$

744 = 700 + 40 + 4
700 ÷ 3 = 2 hundreds with 100 undivided.
100 + 40 = 140.
140 ÷ 3 = 4 tens, with 20 undivided.
20 + 4 = 24, 24 ÷ 3 = 8 ones.
The whole quotient is 2 hundreds 4 tens 8 ones or 248.

Find:

19. 243 ÷ 3 **20.** 358 ÷ 2 **21.** 912 ÷ 3
22. 176 ÷ 2 **23.** 485 ÷ 5 **24.** 870 ÷ 6
25. 556 ÷ 4 **26.** 588 ÷ 7 **27.** 936 ÷ 8
28. 736 ÷ 8 **29.** 972 ÷ 6 **30.** 873 ÷ 9

31. If 558 pears are put into 3 equal piles, how many pears will there be in each pile?

32. Frank paid 325¢ for 5 baskets of grapes. How much was that a basket?

Multiplying by tens.

1. How much is 0 + 0 + 0 + 0?
2. How much, then, is 4 × 0? 6 × 0? 9 × 0?
3. How many are 10 + 10 + 10 + 10?
4. How many, then, are 4 × 10? 10 × 4?
5. How many are 10 × 8? 10 × 17? 10 × 43?

Give an easy rule for multiplying a number by 10.

6. Find 20 times 6.

20 is 10 times 2, and
10 times 2 times 6 = 10 × 12 = 120.

$$\begin{array}{r} 6 \\ \underline{20} \\ 120 \end{array}$$

Multiply the 6 by 2 and to the product, 12, annex a zero.

Multiply:

7. 5 30	**8.** 8 40	**9.** 12 60	**10.** 23 40	**11.** 15 50
12. 9 80	**13.** 7 60	**14.** 18 50	**15.** 27 30	**16.** 24 40

Find:

17. 70 times 8	**18.** 60 × 4	**19.** 30 × 26	**20.** 40 × 24
21. 80 times 9	**22.** 40 × 5	**23.** 50 × 16	**24.** 20 × 49

25. Find the cost of 40 sheep at $6 each.

26. Find the cost of 60 hogs at $8 each.

27. How much oats will it take to feed 30 mules a day if each mule eats 2 pecks?

28. How many quarts are there in 50 gallons?

29. How far will a man travel in 70 hours at the rate of 5 miles per hour?

Multiply 36 by 24.

$$\begin{aligned} 24 &= 20 + 4 \\ 4 \times 36 &= 144 \\ \underline{20} \times 36 &= \underline{720} \\ 24 \times 36 &= 864 \end{aligned} \qquad\qquad \begin{array}{r} 36 \\ \underline{24} \\ 144 \\ \underline{72} \\ 864 \end{array}$$

The right-hand figure of each product is written under the figure by which it is multiplied, as shown on the right.

Multiply:

1. 33 by 12

2. 45 by 21

3. 31 by 32

4. 46 by 14

5. 64 by 15

6. 24 by 29

7. 37 by 18

8. 32 by 24

9. 32 by 28

10. 69 by 13

11. 58 by 16

12. 27 by 27

13. A dealer sold 16 jars of butter, each containing 24 pounds. How many pounds did he sell?

14. A newsboy earns 30 cents a day. How much will he earn in 4 weeks of 7 days each?

15. A farmer had 31 sheep. He sold 17 of them at 6 dollars each and the remainder at 8 dollars each. How much did he receive for all?

16. In a school of 437 pupils there are 189 boys. How many more girls are there than boys?

17. A train runs 301 miles in 7 hours. How many miles is that per hour?

18. Mr. Hill sold 24 cows for \$960. If he received \$48 each for 16 of them, how much did he receive for each of the others?

19. A dealer has 12 cans, each containing 8 qt. of milk. How much is the milk worth at 5 cents a pint?

UNITED STATES MONEY

A number of cents or of dollars and cents is usually expressed by $ and a *period.*

The period, called a **decimal point**, is placed to the right of dollars.

Thus, 5 dollars and 45 cents is written $5.45.

Cents always occupy two places at the right of the point. When the number of cents is less than 10, a naught must be written between it and the point. Thus, 5¢ is written $.05, and $3 and 8¢ is written $3.08.

Neither the sign ($) nor the point (.) should be omitted.

Read:

1. $2.25
2. $1.40
3. $6.05
4. $8.70
5. $4.38
6. $7.08
7. $9.99
8. $ .15
9. $7.65
10. $ .06
11. $ .09
12. $ .75
13. $ .18
14. $3.01
15. $ .07
16. $3.80
17. $ .04
18. $2.90
19. $8.83
20. $5.05

Express by $, a period, and figures:

21. Six dollars
22. Four dollars and twenty cents
23. Three cents
24. Eight dollars and four cents
25. Fifteen cents
26. Four dollars and twelve cents
27. Eight cents
28. Five dollars and fifty-one cents
29. Forty cents
30. Six dollars and forty-two cents
31. Four dollars
32. One dollar and eighty cents
33. Four cents
34. Three dollars and one cent
35. Sixty-one cents
36. Seven dollars and ten cents
37. $6 and 25¢
38. 21¢
39. 4¢
40. $5 and 70¢
41. 75¢
42. 7¢

One hundred cents equal a dollar (100¢ = $1).

1. How many cents are there in $2? in $5? in $8?

2. How many dollars are there in 300¢? in 400¢? in 900¢?

3. How many cents are there in $2.45?

$2.45 = $2 and 45¢ = 200¢ + 45¢ = 245¢.

A number of dollars and cents (like $2.45) *is changed to cents* (245) *by removing the decimal point.*

How many cents are there in:

4. $4.25? 5. $3.84? 6. $6.05? 7. $1.35?
8. $7.08? 9. $2.10? 10. $8.40? 11. $5.00?

12. How many dollars and cents equal 375 cents?

375¢ = 300¢ + 75¢ = $3 and 75¢ = $3.75.

A number of cents (like 375) *is changed to dollars and cents* ($3.75) *by placing the decimal point between the second and third figures from the right.*

How many dollars and cents are there in:

13. 135 cents? 14. 364 cents? 15. 805 cents?
16. 410 cents? 17. 595 cents? 18. 600 cents?

Give the answers to the following in dollars and cents.

Find the cost of:

19. 9 pounds of cheese at 25¢ a pound.
20. 8 pounds of tea at 65¢ a pound.
21. 7 baskets of grapes at 75¢ a basket.
22. 9 dozen eggs at 35¢ a dozen.
23. 8 gallons of vinegar at 28¢ a gallon.
24. 6 gallons of sirup at 45¢ a gallon.

John paid $3.55 for a gun and $4.85 for a saddle. How much did he spend?

$$\begin{array}{l} \$3.55 = 355\text{¢} \\ \underline{\$4.85} = \underline{485\text{¢}} \\ \text{Sum} = 840\text{¢} = \$8.40 \end{array} \qquad \begin{array}{r} \$3.55 \\ \underline{4.85} \\ \$8.40 \end{array}$$

In practice the work is done as shown on the right.

Ella's dress cost $9 and Ann's dress cost $6.25. How much more did Ella's dress cost than Ann's?

$$\begin{array}{r} \$9 \quad = 900\text{¢} \\ \underline{\$6.25} = \underline{625\text{¢}} \\ \text{Difference} = 275\text{¢} = \$2.75 \end{array} \qquad \begin{array}{r} \$9.00 \\ \underline{6.25} \\ \$2.75 \end{array}$$

In practice the work is done as shown on the right.

In addition and subtraction of dollars and cents, the point must be written under the point, dollars under dollars, and cents under cents.

First add; then subtract:

1. $4.80 and $1.75	2. $5 and $3.15
3. $6.05 and $2.78	4. $7 and $1.53
5. $3.50 and $2.95	6. $8 and $ .45

7. One book cost $4.35 and another $2.95. How much did both books cost? How much more did the first book cost than the second?

8. Find $2.40 + $3 + $1.28 + $.47.

9. Find $1.86 + $5 + $2.09 − $4.78.

10. George had $5.40; he spent $3.75. How much had he left?

11. Mary bought a parasol for $1.45, and handed the clerk a two-dollar bill. How much change should she receive?

Find the cost of 3 footballs at $1.45 apiece:

$$\begin{array}{r} \$1.45 = 145¢ \\ 3 \\ \hline 435¢ = \$4.35 \end{array} \qquad\qquad \begin{array}{r} \$1.45 \\ 3 \\ \hline \$4.35 \end{array}$$

In practice the work is done as shown on the right.

How much is $\frac{1}{5}$ of $8.35?

$$\begin{array}{r} \$8.35 = 835¢ \\ 5\overline{)835¢} \\ \hline 167¢ = \$1.67 \end{array} \qquad\qquad \begin{array}{r} 5\overline{)\$8.35} \\ \hline \$1.67 \end{array}$$

In practice the work is done as shown on the right.

In multiplying or dividing dollars and cents by a whole number, the decimal point in the answer is written under the decimal point in the given number.

Multiply:

1. $\begin{array}{r} \$2.26 \\ 4 \\ \hline \end{array}$ 2. $\begin{array}{r} \$1.85 \\ 5 \\ \hline \end{array}$ 3. $\begin{array}{r} \$.58 \\ 9 \\ \hline \end{array}$ 4. $\begin{array}{r} \$3.25 \\ 3 \\ \hline \end{array}$

5. $\begin{array}{r} \$1.38 \\ 7 \\ \hline \end{array}$ 6. $\begin{array}{r} \$1.59 \\ 6 \\ \hline \end{array}$ 7. $\begin{array}{r} \$.89 \\ 8 \\ \hline \end{array}$ 8. $\begin{array}{r} \$1.07 \\ 9 \\ \hline \end{array}$

Divide:

9. $3\overline{)\$8.25}$ 10. $4\overline{)\$7.56}$ 11. $8\overline{)\$4.32}$ 12. $6\overline{)\$5.76}$

13. $9\overline{)\$9.45}$ 14. $7\overline{)\$9.45}$ 15. $5\overline{)\$.65}$ 16. $8\overline{)\$.56}$

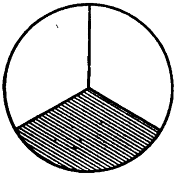
17. Find the cost of 9 bushels of corn at $.65 a bushel.

18. If $8.94 is divided equally among 6 boys, how much will each boy receive?

19. How much is $\frac{1}{4}$ of $9.84?

FRACTIONS

1. Into how many equal parts must a thing be divided to get $\frac{1}{2}$ of it? $\frac{1}{3}$ of it? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{10}$?



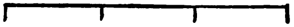
2. What part of this circle is shaded?

3. What part is not shaded?

4. How much is $\frac{1}{3}+\frac{1}{3}$? $2\times\frac{1}{3}$?

5. How is two thirds written?

6. Point out $\frac{2}{3}$ of this line.



7. Find $\frac{2}{3}$ of 12.

$$\tfrac{2}{3} \text{ of } 12 \text{ is } 2\times\tfrac{1}{3} \text{ of } 12 = 2\times 4 = 8.$$

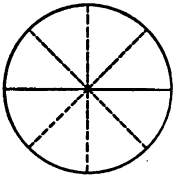
8. Read the following, and tell what each means:

$\frac{4}{5}$. *Ans.* Four fifths; means 4 times $\frac{1}{5}$.

$\frac{2}{5}$; $\frac{3}{7}$; $\frac{4}{9}$; $\frac{5}{6}$; $\frac{3}{10}$; $\frac{9}{10}$; $\frac{5}{2}$; $\frac{7}{3}$; $\frac{9}{4}$; $\frac{13}{20}$.

9. Write in figures: Three fifths; five sixths; seven tenths; two fifteenths; five eighths; four ninths; one twelfth; five hundredths.

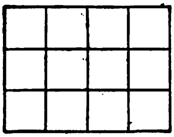
Tell how you would find:



10. $\frac{5}{8}$ of a circle.

11. $\frac{3}{8}$ of a circle.

12. $\frac{3}{4}$ of a circle.



13. $\frac{2}{3}$ of this oblong.

14. $\frac{3}{4}$ of this oblong.

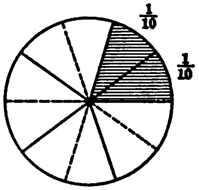
15. $\frac{5}{6}$ of this oblong.

A **fraction** is one or more of the equal parts of a single thing.

The **terms** of a fraction are the two numbers used to express it.

Thus, the terms of $\frac{3}{8}$ are 3 and 8.

1. Which of the terms is the numerator? the denominator?



2. In the fraction $\frac{2}{10}$, what does the denominator (10) show? What does the numerator (2) show?

3. Dividing both terms of $\frac{2}{10}$ by 2 gives $\frac{1}{5}$. Show by the figure that $\frac{2}{10} = \frac{1}{5}$.

Dividing both terms of a fraction by any number does not change the value of the fraction.

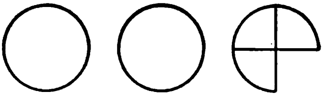
4. Find the simplest way of writing $\frac{12}{18}$.

First, divide 12 and 18 each by 2, which gives $\frac{6}{9}$.
Then, divide 6 and 9 each by 3, which gives $\frac{2}{3}$.
As no number will divide 2 and 3, the simplest way of writing $\frac{12}{18}$ is $\frac{2}{3}$.

$$\frac{12}{18} = \frac{6}{9} = \frac{2}{3}.$$

Write in the simplest way:

5. $\frac{2}{4}$ of a dollar
6. $\frac{10}{12}$ of a quart
7. $\frac{18}{24}$
8. $\frac{6}{8}$ of a bushel
9. $\frac{15}{24}$ of a melon
10. $\frac{24}{42}$
11. $\frac{3}{9}$ of a circle
12. $\frac{24}{36}$ of an inch
13. $\frac{27}{45}$
14. $\frac{3}{6}$ of a square
15. $\frac{30}{75}$ of a chain
16. $\frac{54}{90}$
17. $\frac{2}{8}$ of a gallon
18. $\frac{48}{80}$ of an acre
19. $\frac{72}{96}$
20. $\frac{4}{8}$ of an apple
21. $\frac{36}{48}$ of a quart
22. $\frac{64}{80}$
23. $\frac{6}{9}$ of a month
24. $\frac{36}{80}$ of a year
25. $\frac{42}{63}$



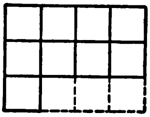
1. How many whole circles are here? how many fourths of a circle over?

Two equal whole things and $\frac{3}{4}$ of another equal thing is written $2\frac{3}{4}$; and read, two and three fourths.

A **mixed number**, like $2\frac{3}{4}$, is a whole number united with a fraction.

2. Read the following, and tell what each means:

$2\frac{1}{2}$; $1\frac{3}{4}$; $7\frac{3}{8}$; $5\frac{7}{12}$; $6\frac{3}{20}$; $9\frac{1}{10}$; $8\frac{1}{100}$.



3. How many 4's make 8?

Ans. 2, because 8 = 2 fours.

4. How many 4's make 9?

Ans. $2\frac{1}{4}$, because 9 = 2 fours and $\frac{1}{4}$ of another four.

5. How many 4's make 10? 11? 12?

6. How many 3's make 9? 10? 11? 12? 13? 14?

7. How many 5's make 15? 16? 17? 18? 19? 20?

8. Divide 23 by 6.

In 23 there are 3 sixes and $\frac{5}{6}$ of another six; hence the answer is $3\frac{5}{6}$.

Divide:

9. 2)17 **10.** 3)20 **11.** 4)15 **12.** 5)28 **13.** 6)27

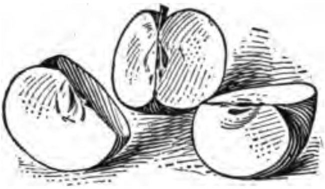
14. 7)37 **15.** 8)35 **16.** 9)17 **17.** 3)28 **18.** 5)42

19. 4)31 **20.** 6)47 **21.** 7)51 **22.** 9)70 **23.** 8)53

24. $\frac{41}{9}$ **25.** $\frac{26}{4}$ **26.** $\frac{79}{8}$ **27.** $\frac{68}{7}$ **28.** $\frac{55}{6}$

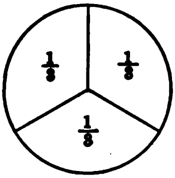
THIRDS

One (1)



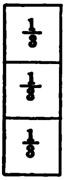
Thirds ($\frac{1}{3}$'s)

One (1)



Thirds ($\frac{1}{3}$'s)

One (1)

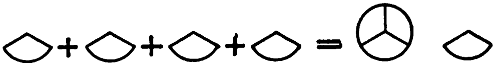


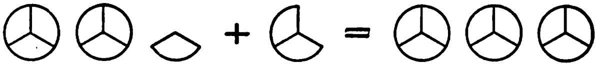
Thirds ($\frac{1}{3}$'s)

1. How many thirds of an apple are there in 1 apple? How many thirds of a circle equal 1 circle? How many $\frac{1}{3}$'s equal 1?

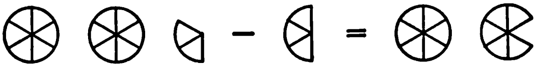
2. Point out 2 thirds of the apple; $\frac{2}{3}$ of the circle.

Read the following and write them in figures:

3. 

4. 

5. Make like pictures for $1\frac{1}{3} + \frac{2}{3} = 2$; $2\frac{1}{3} + 3\frac{1}{3} = 5\frac{2}{3}$.

6. Read: 

7. Write it in figures.

8. Make like pictures for $4\frac{5}{6} - \frac{2}{3} = 4\frac{1}{6}$; $4\frac{1}{6} - 2\frac{1}{3} = 1\frac{5}{6}$.

Add:

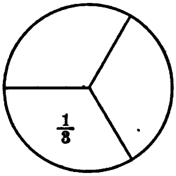
9.	10.	11.	12.	13.	14.
$\$3\frac{1}{3}$	$\$5$	$4\frac{1}{3}$	7	$5\frac{1}{3}$	$8\frac{1}{3}$
8	$1\frac{2}{3}$	$6\frac{1}{3}$	$9\frac{1}{3}$	$6\frac{1}{3}$	$7\frac{2}{3}$

Subtract:

15.	16.	17.	18.	19.	20.
$\$7\frac{1}{3}$	$\$5\frac{2}{3}$	$9\frac{2}{3}$	15	10	$11\frac{1}{3}$
4	$1\frac{1}{3}$	6	$10\frac{1}{3}$	$8\frac{2}{3}$	$6\frac{2}{3}$

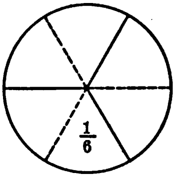
THIRDS, SIXTHS, AND TWELFTHS

One (1)



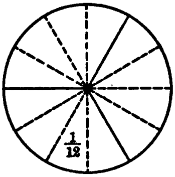
Thirds ($\frac{1}{3}$'s)

One (1)



Sixths ($\frac{1}{6}$'s)

One (1)



Twelfths ($\frac{1}{12}$'s)

1. How many $\frac{1}{3}$'s are there in 1?
2. How many $\frac{1}{6}$'s are there in 1? in $\frac{1}{3}$? in $\frac{1}{2}$?
3. How many $\frac{1}{12}$'s are there in 1? in $\frac{1}{6}$? in $\frac{1}{4}$? in $\frac{1}{3}$?
4. Tell what numerators belong in the vacant places:

$\frac{1}{2}=\frac{}{6}$ $\frac{1}{2}=\frac{}{12}$ $\frac{1}{3}=\frac{}{6}$ $\frac{1}{3}=\frac{}{12}$ $\frac{2}{3}=\frac{}{12}$

$\frac{1}{4}=\frac{}{12}$ $\frac{2}{4}=\frac{}{12}$ $\frac{3}{4}=\frac{}{12}$ $\frac{1}{6}=\frac{}{12}$ $\frac{2}{6}=\frac{}{12}$

Add:

5.	6.	7.	8.	9.	10.
$\$3\frac{1}{3}$	$\$5$	$4\frac{1}{3}$	7	$5\frac{1}{3}$	$8\frac{1}{3}$
8	$1\frac{2}{3}$	$6\frac{1}{3}$	$9\frac{1}{3}$	$6\frac{1}{3}$	$7\frac{2}{3}$
$2\frac{1}{3}$	$7\frac{1}{3}$	$5\frac{1}{3}$	$4\frac{2}{3}$	$2\frac{2}{3}$	$9\frac{2}{3}$

Subtract:

11.	12.	13.	14.	15.	16.
$\$9\frac{1}{3}$	$\$6\frac{2}{3}$	$8\frac{2}{3}$	$15\frac{1}{3}$	$40\frac{2}{3}$	$31\frac{2}{3}$
6	$2\frac{1}{3}$	5	$10\frac{1}{3}$	8	$6\frac{1}{3}$

Add:

17.	18.	19.	20.	21.	22.
9	$8\frac{1}{2}$	$5\frac{1}{3}$	$7\frac{2}{3}$	$8\frac{1}{2}$	$10\frac{1}{2}$
$3\frac{5}{6}$	$5\frac{1}{6}$	$4\frac{1}{6}$	$3\frac{1}{2}$	$6\frac{5}{6}$	$7\frac{2}{3}$

Subtract:

23.	24.	25.	26.	27.	28.
$4\frac{5}{6}$	$3\frac{1}{2}$	$4\frac{2}{3}$	$5\frac{2}{3}$	$8\frac{5}{6}$	$12\frac{1}{2}$
$2\frac{1}{6}$	$1\frac{1}{3}$	$3\frac{1}{6}$	$2\frac{1}{2}$	$4\frac{1}{2}$	$9\frac{1}{6}$

Find the sum of $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$.

$$\begin{aligned} \frac{1}{2}&=\frac{6\times 1}{6\times 2}=\frac{6}{12}\\ \frac{2}{3}&=\frac{4\times 2}{4\times 3}=\frac{8}{12}\\ \frac{3}{4}&=\frac{3\times 3}{3\times 4}=\frac{9}{12}\\ \text{Sum}&\qquad\quad=\tfrac{23}{12}=1\tfrac{11}{12} \end{aligned}$$

Before these fractions can be added, they must be changed so as to have the same denominators.

Since 12 is the least number that all the denominators will exactly divide, take it for the common denominator, then multiply both terms of each fraction by the number of times its denominator is contained in 12.

Thus, multiply both terms of $\frac{1}{2}$ by 6, because $12 \div 2 = 6$; both terms of $\frac{2}{3}$ by 4, because $12 \div 3 = 4$; and both terms of $\frac{3}{4}$ by 3, because $12 \div 4 = 3$.

Find first the sum and then the difference of $6\frac{5}{6}$ and $3\frac{1}{4}$.

$$\begin{array}{rl} 6\frac{5}{6}= & 6\frac{10}{12}\\ 3\frac{1}{4}= & \underline{3\frac{3}{12}}\\ \text{Sum }= & 9\frac{13}{12}=10\frac{1}{12} \end{array} \qquad\qquad \begin{array}{rl} 6\frac{5}{6}= & 6\frac{10}{12}\\ 3\frac{1}{4}= & \underline{3\frac{3}{12}}\\ \text{Difference }= & 3\frac{7}{12} \end{array}$$

Find first the sum and then the difference:

$$\begin{array}{lllll} \textbf{1.}\ \ 2\frac{1}{4} & \textbf{2.}\ \ 7\frac{1}{3} & \textbf{3.}\ \ 8\frac{3}{4} & \textbf{4.}\ \ 6\frac{1}{2} & \textbf{5.}\ \ 9\frac{2}{3}\\ \quad\ \underline{1\frac{1}{6}} & \quad\ \underline{2\frac{1}{4}} & \quad\ \underline{2\frac{1}{3}} & \quad\ \underline{5\frac{5}{12}} & \quad\ \underline{2\frac{7}{12}} \end{array}$$

6. Frank's height is $4\frac{3}{4}$ ft. and Bob's is $4\frac{2}{3}$ ft. How much taller is Frank than Bob?

7. James walked $5\frac{1}{6}$ miles one day, $4\frac{2}{3}$ miles the next day, and $6\frac{1}{4}$ miles the third day. How far did he walk in the three days?

8. Nellie bought $16\frac{3}{4}$ yd. ribbon and Lucy bought $12\frac{5}{6}$ yd. How many yards did both buy? How much more did Nellie buy than Lucy?

9. John worked $5\frac{1}{3}$ hours in the morning and $2\frac{3}{4}$ hours in the evening. How much longer did he work in the morning than in the evening?

Find $\frac{3}{4}$ of 20.

How is $\frac{1}{4}$ of a number found?
$\frac{3}{4}$ is how many times $\frac{1}{4}$?

$\frac{1}{4}$ of $20 = 5$
$\frac{3}{4}$ of $20 = 3 \times 5 = 15$.

Find quickly:

1. $\frac{1}{2}$ of 8; 12; 36; 40; 64; 72; 88; 96; 100.
2. $\frac{1}{3}$ and $\frac{2}{3}$ of 12; 21; 36; 42; 54; 60; 90.
3. $\frac{1}{4}$ and $\frac{3}{4}$ of 16; 28; 36; 40; 56; 60; 100.
4. $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, and $\frac{4}{5}$ of 15; 25; 40; 50; 75; 100.

Find:

5. $\frac{3}{4}$ of $32
6. $\frac{4}{5}$ of 30
7. $\frac{2}{3}$ of 75 cents
8. $\frac{5}{6}$ of $54
9. $\frac{3}{7}$ of 21
10. $\frac{3}{5}$ of 80 pints
11. $\frac{3}{8}$ of $72
12. $\frac{5}{8}$ of 40
13. $\frac{4}{9}$ of 45 pecks
14. $\frac{5}{9}$ of $63
15. $\frac{7}{9}$ of 81
16. $\frac{5}{7}$ of 84 birds

Find:

17. $\frac{2}{3}$ of 504
18. $\frac{3}{8}$ of 504 bu.
19. $\frac{1}{2}$ of 912¢
20. $\frac{3}{4}$ of 328
21. $\frac{4}{9}$ of 207 qt.
22. $\frac{2}{9}$ of 837¢
23. $\frac{4}{5}$ of 275
24. $\frac{3}{7}$ of 609 ft.
25. $\frac{4}{5}$ of 985¢
26. $\frac{5}{8}$ of 592
27. $\frac{5}{6}$ of 942 ft.
28. $\frac{7}{8}$ of 992¢

29. If a pound of butter is worth 32¢, how much is $\frac{5}{8}$ of a pound worth?

30. A barrel of flour weighs 196 pounds. Find the weight of $\frac{3}{4}$ of a barrel.

31. A has $180, and B has $\frac{3}{5}$ as much as A. How many dollars has B?

32. There are 60 minutes in an hour. How many minutes are there in $\frac{5}{6}$ of an hour?

Multiply 8 by $5\frac{3}{4}$.

$5\frac{3}{4}$ times 8 means $\frac{3}{4}$ of $8 + 5 \times 8 = 6 + 40 = 46$.

$$\begin{array}{r} 8 \\ \underline{5\frac{3}{4}} \\ 6 \\ \underline{40} \\ 46 \end{array}$$

Multiply 15 by $3\frac{4}{5}$.

$$\begin{array}{rl} \frac{4}{5} \text{ of } 15 &= 12 \\ \underline{3\phantom{\frac{4}{5}}} \times 15 &= \underline{45} \\ 3\frac{4}{5} \times 15 &= 57 \end{array}$$

$$\begin{array}{r} 15 \\ \underline{3\frac{4}{5}} \\ 12 \\ \underline{45} \\ 57 \end{array}$$

Find:

1. $4\frac{1}{2} \times 4$ ft.
2. $9\frac{3}{5} \times 20$
3. $5\frac{2}{3} \times 48$
4. $3\frac{2}{3} \times 6$ in.
5. $7\frac{5}{6} \times 30$
6. $7\frac{2}{5} \times 65$
7. $5\frac{1}{3} \times 9$ yd.
8. $6\frac{3}{8} \times 40$
9. $8\frac{3}{4} \times 72$
10. $7\frac{3}{4} \times 8$ pt.
11. $8\frac{2}{7} \times 21$
12. $6\frac{5}{8} \times 96$

13. Multiply 42 by $5\frac{1}{2}$
14. Multiply 63 by $6\frac{5}{9}$
15. Multiply 39 by $4\frac{2}{3}$
16. Multiply 35 by $9\frac{3}{7}$
17. Multiply 54 by $7\frac{1}{6}$
18. Multiply 56 by $7\frac{5}{8}$

19. Multiply 235 by $3\frac{3}{5}$

$$\begin{array}{rl} \frac{1}{5} \text{ of } 235 &= \underline{47} \\ \frac{3}{5} \text{ of } 235 &= 141 \quad (= 3 \times 47) \\ \underline{3\phantom{\frac{3}{5}}} \times 235 &= \underline{705} \\ 3\frac{3}{5} \times 235 &= 846 \end{array}$$

$$\begin{array}{r} 235 \\ \underline{3\frac{3}{5}} \\ 141 \\ \underline{705} \\ 846 \end{array}$$

20. Multiply 104 by $8\frac{1}{2}$
21. Multiply 81 by $9\frac{7}{9}$
22. Multiply 126 by $5\frac{2}{3}$
23. Multiply 96 by $8\frac{3}{8}$
24. Multiply 212 by $3\frac{3}{4}$
25. Multiply 91 by $6\frac{5}{7}$
26. Multiply 125 by $7\frac{2}{5}$
27. Multiply 78 by $8\frac{5}{6}$
28. Multiply 144 by $6\frac{1}{6}$
29. Multiply 98 by $7\frac{6}{7}$

1. There are 8 pints in 1 gallon. How many pints are there in 5½ gallons? in 6¾ gallons?

2. How much will 3½ pounds of nuts cost at 20 cents a pound?

3. How much will 5⅛ pounds of rice cost at 8 cents a pound?

4. A lady bought 9½ pounds of sugar. How much did it cost at 6 cents a pound?

5. A box contains 15¾ pounds of grits. How much is it worth at 4 cents a pound?

6. At 40 cents a pound, how much is 1⅝ pounds of butter worth?

7. Find the cost of 7¼ yards of ribbon at 12 cents a yard.

8. How many quarts are there in 5½ gallons?

9. How many inches are there in 6⅔ feet?

10. How many quarts are there in 4¾ pecks?

11. John bought pears at 1¢ each and sold them at 20¢ a dozen. How much did he gain on 1 dozen? on 5¾ dozen?

12. Ella and Ann gathered 1¾ pecks of berries and sold them at 5 cents a quart. How much did they receive for them?

13. Find the value of 3½ gallons of milk at 10 cents a quart.

14. Henry worked 3½ hours in the morning and 2¼ hours in the evening. How much did he receive for his work at 12 cents an hour?

15. Frank and Robert gathered 144 apples. They sold ⅝ of them, ate ⅓ of the remainder, and gave what was left to the teacher. How many apples did the teacher receive?

ANALYSIS

1. Find $3\frac{1}{2} \times \$4$ by multiplication.

2. Find $4 \times \$3\frac{1}{2}$ by addition.

3. Is $3\frac{1}{2} \times \$4$ just as much as $4 \times \$3\frac{1}{2}$?

4. Find $3\frac{1}{2} \times 6$¢; $6 \times 3\frac{1}{2}$¢; $2\frac{1}{4} \times \$8$; $8 \times \$2\frac{1}{4}$.

5. Find $12 \times 2\frac{3}{4}$.

$12 \times 2 = 24$, $12 \times \frac{3}{4} = \frac{3}{4}$ of $12 = 9$; $24 + 9 = 33$.

6. Find $8 \times 2\frac{1}{4}$; $16 \times 5\frac{3}{8}$; $20 \times 4\frac{3}{4}$.

7. If 4 apples cost 10¢, how much will 18 apples cost?

If 4 apples cost 10¢, 1 apple will cost $\frac{1}{4}$ of 10¢, or $2\frac{1}{2}$¢; therefore 18 apples will cost $18 \times 2\frac{1}{2}$¢, or 45¢.

If 4 apples cost 10¢,
1 apple costs $2\frac{1}{2}$¢,
18 apples cost 45¢.

8. If 4 hats cost $12, how much will 6 hats cost?

9. If 6 cows cost $84, how much will 7 cows cost?

10. Ella paid 30¢ for 2 yards of ribbon. How much would 5 yards cost at the same rate?

11. James rode on his bicycle 26 miles in 4 hours. How far would he ride in 10 hours at the same rate?

12. Mary went into a fruit store where one barrel of apples was labeled "3 for 10¢," another "6 for 15¢," and another "5 for 20¢."

(*a*) How much would 15 apples of the first kind cost?
(*b*) How much would 20 apples of the third kind cost?
(*c*) How much would 18 apples of the second kind cost?
(*d*) How many apples of the third kind could be bought for $1?

13. A man paid $78 for 4 calves, and wishes to buy 26 more at the same price. How much will they cost?

COTTON

Two Stalks of Cotton

A Boll of Cotton

1. On one stalk of cotton there are 18 bolls, on another 24, and on a third 37. How many bolls are there on the three stalks?

2. Eight stalks of cotton have an average of 24 bolls each. How many bolls are there in all?

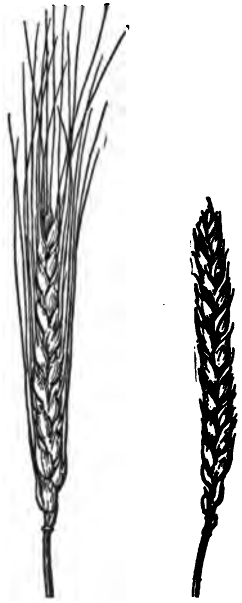
3. If 82 bolls produce a pound of seed cotton, how many bolls will produce 9 pounds?

4. How many bales of cotton will 235 acres produce at the rate of $\frac{3}{5}$ of a bale per acre?

5. In a quantity of seed cotton the weight of the seed is about 2 times the weight of the lint. How much of lint and of seed are there in 915 pounds of seed cotton?

6. The weight of the ties and bagging on a bale of cotton is about 25 pounds. How much do the ties and bagging on 37 bales weigh?

7. Find the value of 76 pounds of lint cotton at $9\frac{3}{4}$ cents a pound.



TWO HEADS OF WHEAT

1. Henry has 5 heads of wheat containing, respectively, 28, 36, 24, 37, and 39 grains. How many grains are there in all?

2. How many grains of wheat are there in 26 heads if each head has an average of 39 grains?

3. If each grain when planted produces 6 stalks, how many stalks will 87 grains produce?

4. If one bushel of wheat produces 18 bushels, what will be the yield of 39 bushels?

5. One bushel of wheat weighs 60 pounds. Find the weight of $6\frac{3}{4}$ bushels.

6. How many grains of rice are there in 7 heads if each head has 135 grains?

7. If 8 heads of oats have 360 grains, what is the average number per head?

8. A bushel of oats weighs 32 pounds. Find the weight of 8 sacks of oats, each containing $3\frac{1}{2}$ bushels.

9. How many bushels of wheat will $36\frac{1}{2}$ acres of land produce at the rate of 16 bushels per acre?

10. A farmer gathered from 9 acres 324 bushels of oats. How much was that per acre?

11. If 5 sacks of rough rice weigh 930 pounds, what is the average weight per sack?

12. How much more will 12 bushels of wheat weigh than 19 bushels of oats?

VI. BILLIONS, MILLIONS, THOUSANDS, AND ONES

1000 ones = a thousand, written 1,000.
1000 thousands = a million, written 1,000,000.
1000 millions = a billion, written 1,000,000,000.

If a large number, expressed in figures, is separated into periods of three figures each, beginning at the right, the *first* period expresses **ones**, the *second* **thousands**, the *third* **millions**, and the *fourth*, **billions**.

Thus, separating 37809063 into periods, we have 37,809,063, which means 37 millions 809 thousands 63 ones, and is read, thirty-seven million eight hundred nine thousand sixty-three.

Notation is writing a number in figures, and **numeration** is naming or reading a number in words.

In the following the pupil should show, by periods, how the numeration comes from the notation, and *vice versa.*

1. 8420; eight thousand four hundred twenty.
2. 25,012; twenty-five thousand twelve.
3. 601,005; six hundred one thousand five.
4. 3,010,049; three million ten thousand forty-nine.
5. 42,000,800; forty-two million eight hundred.
6. 500,050,005; five hundred million fifty thousand five.
7. 645,000,002; six hundred forty-five million two.
8. 324,905,628; three hundred twenty-four million nine hundred five thousand six hundred twenty-eight.

The word "and" should never be used in reading whole numbers.

Write in words:

1. 3140
2. 48,425
3. 267,918
4. 2017
5. 70,060
6. 530,009
7. 4003
8. 81,672
9. 800,060
10. 9999
11. 99,999
12. 999,999

Write in figures:

13. Three hundred seventy-four thousand eighty-nine.
14. Eight hundred eighty-three thousand seventy-one.
15. Sixty-seven thousand three hundred ninety-eight.
16. Five hundred thousand four hundred thirty-three.
17. Forty-eight thousand eight hundred seventy-nine.

Write in words:

18. 4,205,364
19. 30,016,000
20. 200,800,500
21. 3,069,502
22. 48,650,570
23. 301,904,207
24. 9,610,008
25. 70,888,111
26. 444,666,888
27. 6,000,006
28. 23,456,789
29. 999,999,999

Write in figures:

30. 63 millions 408 thousands 21 ones.
31. 125 millions 41 thousands 307 ones.
32. 209 millions 3 thousands 500 ones.
33. 460 millions 17 ones.
34. 9 millions 9 thousands 9 ones.
35. Fifteen million three hundred thousand five.
36. Twelve million seven hundred eighty-nine.
37. Six hundred twenty million fifteen thousand.
38. Eight hundred six billion one thousand ten.

REVIEW

1. Name the first ten multiples of 7; of 8; 9.

2. Count by 8's from 6 to 70.

3. Count by $2\frac{1}{2}$'s from 5 to 25.

4. Find, by addition and by multiplication, the first nine multiples of 24.

Thus, 1st, 24; 2d, $24 + 24 = 48$, $2 \times 24 = 48$; and so on.

5. Find, in like manner, the first nine multiples of 86.

6. Find, by addition, the first nine multiples of $3\frac{1}{4}$.

Thus, 1st, $3\frac{1}{4}$; 2d, $3\frac{1}{4} + 3\frac{1}{4} = 6\frac{1}{2}$; 3d, $6\frac{1}{2} + 3\frac{1}{4} = 9\frac{3}{4}$; etc.

7. Find, in like manner, the first nine multiples of $2\frac{1}{3}$.

8. The weights of four boys are $72\frac{1}{2}$ lb., 84 lb., $76\frac{3}{4}$ lb., and $65\frac{3}{8}$ lb. Find their total weight.

9. A man asked $160 for a horse, but sold it for $$12\frac{1}{2}$ less. How much did he receive for it?

10. How many inches are there in $3\frac{2}{3}$ yards?

11. A train ran from station A to station B in 43 minutes. If it left A at 8:37 o'clock, what were the positions of the hands of the clock when it reached B?

12. How many hours and minutes are there between 9:35 A.M. and 4:15 P.M.?

13. Find the sum of the quotients $896 \div 7$ and $945 \div 9$.

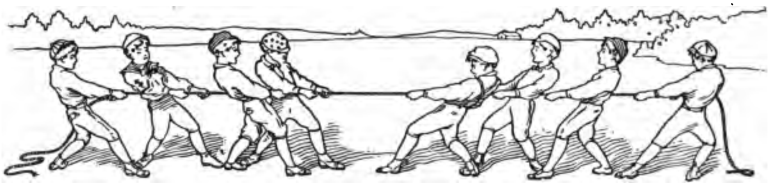
14. How many pints are there in 79 gallons?

15. How many bushels are there in 928 quarts?

16. If 6 hats cost $21, how much will 8 hats cost?

17. Mary bought a book for 45¢, a tablet for 10¢, a bottle of ink for 5¢, and a pencil for 3¢, and gave the clerk three quarters of a dollar. How did the clerk make change?

ADDITION



In this game of "tug-of-war" the boys who pull together are said to be *united.*

1. How many boys are united on each side?

2. Two boys united with 2 boys are how many boys?

3. Five men united with 4 men are how many men?

4. If a 6-pound weight and a 4-pound weight were united into one weight, what weight would it be?

5. What sum of money is equal to $8 united with $7?

6. What is the result of uniting 9, 4, and 3 into one number?

Addition is the operation of uniting two or more numbers into one number.

The **addends** are the numbers added.

7. What is the sign of addition?

8. What is the result of addition called?

PRINCIPLES. *The addends may be taken in any order.*

Thus, $6 + 4 + 3 = 6 + 3 + 4 = 3 + 4 + 6$.

Only like numbers can be added.

Tell how the following may be added:

9. 3 quarts and 2 gallons; 2 yd. and 1 ft.

10. 3 halves and 2 eighths; $\frac{3}{4}$ and $\frac{1}{6}$.

How many pupils are there in three schools, if one has 1637 pupils, another 785 pupils, and the third 94 pupils?

$$\begin{array}{r}1637\\785\\\underline{94}\\2516\end{array}$$

Do not think or say "4 and 5 are 9 and 9 and 7 are 16," but think or say "4, 9, 16."

Write 6 in the ones' place, and add the 1 ten to the tens, thus: "1, 10, 18, 21."

Write 1 in the tens' place, and add the 2 to the hundreds, thus: "2, 9, 15."

Write 5 in the hundreds' place, and add 1 to the thousands, thus: "1, 2." Write 2 in the thousands' place. Read the sum.

Check. Adding downward, 7, 12, 16; 1, 4, 12, 21; 2, 8, 15; 2.

Add and check:

1.	**2.**	**3.**	**4.**	**5.**	**6.**
195	321	652	478	580	767
36	64	76	89	63	27
48	79	81	67	94	57

7.	**8.**	**9.**	**10.**	**11.**	**12.**
687	523	917	852	774	688
345	684	737	699	908	707
34	49	75	68	87	95

13.	**14.**	**15.**	**16.**	**17.**	**18.**
939	818	729	608	590	486
827	706	695	587	405	705
705	694	581	446	967	628
206	164	99	37	836	594

19.	**20.**	**21.**	**22.**	**23.**	**24.**
423	758	951	527	819	407
324	375	764	152	721	624
654	703	832	36	58	89
543	9	666	587	76	99
840	98	275	784	365	8

1. A school has 436 pupils in the primary department, 295 in the grammar department, and 187 in the high school. How many pupils are there in all?

2. Mr. Taylor bought a city lot for $1875 and built a house on it for $8729. How much did the property cost?

3. How many books are there in three bookcases, if one contains 386 books, another 297 books, and the third 425 books?

4. What was the value of a farmer's crop, if his cotton was worth $2175, corn, $1360, and potatoes, $398?

5. Mr. Morgan has four horses whose weights are 1224 pounds, 1196 pounds, 1057 pounds, and 978 pounds, respectively. Find the weight of all.

6. A boy at college in one year paid $125 for tuition, $185 for board, $63 for car fare, $108 for clothing and shoes, and $17 for books. What were his entire expenses?

7. A dealer shipped 842 head of cattle, 739 hogs, 1276 sheep; and then had left 40 head of cattle, 254 hogs, and 175 sheep. How many animals had he at first?

8. A man bought a tract of land for $4327, cleared and fenced it for $3192, and then sold it for $1768 more than its total cost. How much did he receive?

9. Mr. Taylor paid $275 for rent, $568 for food and clothing, $189 for other expenses, and had $368 of his salary left. Find his yearly salary.

10. A, B, C, and D each bought an automobile; A's cost $1875, B's $2125, C's $1680, and D's $3250. How much did all the machines cost?

11. Henry drew on his cart 18 lb. flour, $12\frac{1}{2}$ lb. bacon, $6\frac{3}{4}$ lb. sugar, and $1\frac{5}{8}$ lb. coffee. How much did the load weigh?

1. It is 183 miles from New Orleans to Jackson, Miss.,
213 miles from Jackson to Memphis, Tenn.,
525 miles from Memphis to Chicago.
How far is it from New Orleans to Chicago?

2. It is 318 miles from New Orleans to Montgomery, Ala.,
175 miles from Montgomery to Atlanta, Ga.,
192 miles from Atlanta to Spartanburg, S.C.,
169 miles from Spartanburg to Greensboro, N.C.,
288 miles from Greensboro to Washington, D.C.
How far is it from New Orleans to Washington?

3. It is 363 miles from New Orleans to Houston, Tex.,
209 miles from Houston to San Antonio,
620 miles from San Antonio to El Paso,
811 miles from El Paso to Los Angeles,
484 miles from Los Angeles to San Francisco.
How far is it from New Orleans to San Francisco?

4. It is 964 miles from New York to Chicago, Ill.,
293 miles from Chicago to St. Louis, Mo.,
923 miles from St. Louis to Denver, Col.,
742 miles from Denver to Salt Lake, Utah,
823 miles from Salt Lake to San Francisco.
How far is it from New York to San Francisco?

Add rapidly and check:

1.	**2.**	**3.**	**4.**	**5.**
346	5038	83,207	37,097	18
248	9216	79,346	48,153	263
174	6015	23,705	37,988	4,913
598	3748	25,863	29,883	83,122
309	7668	18,941	26,854	24,987
544	6489	30,638	40,744	4,764
399	8787	21,678	10,399	879
643	2563	19,327	32,366	84

6.	**7.**	**8.**	**9.**	**10.**
$43.35	$16.80	$543.25	$258.75	$7.60
37.24	85.96	237.85	425.32	2.95
86.73	28.37	840.42	762.78	1.05
91.10	43.43	982.83	408.64	.68
16.66	38.55	468.62	683.37	.74
53.89	67.68	249.98	532.69	8.79
48.66	99.44	517.74	895.83	.85
24.57	73.29	438.39	926.76	6.57
62.98	85.75	555.55	377.39	.36
78.48	48.86	683.92	889.81	5.65

Find the value of:

11. 324 + 4679 + 64 + 6457 + 389 + 4642.

12. 3468 + 315 + 8600 + 18 + 5784 + 428.

13. 87 + 3649 + 592 + 58 + 84,397 + 7396.

14. 42,537 + 987 + 8645 + 98 + 674 + 999.

15. 19 + 482 + 6789 + 53,729 + 76 + 7943.

16. 9645 + 597 + 65 + 87 + 7965 + 49,558.

Find the sum of $6.38, $238, and $79.45.

When numbers of dollars and cents are to be added, how are the points to be written? See page 113.

$$\begin{array}{r} \$\quad 6.38 \\ 238. \\ 79.45 \\ \hline \$323.83 \end{array}$$

Find the sum of:

1. $34.52, $68.75, $304.53, $98.07, $9.50, $16.45.
2. $36.27, $5.96, $1208, $78.42, $304.65, $864.70.
3. $9.85, $27.30, $586.54, $.55, $16.29, $5482.64.
4. $4003.40, $841.67, $83.96, $8.57, $.75, $67.69.
5. $8.28, $7650.48, $859.32, $77.44, $666, $81.55.
6. $33.35, $3045.45, $6.68, $819.71, $4825, $8.64.

7. Mr. Hicks owes Mr. Johnson $130.50, Mr. Jackson $475.12, Mr. Turner $980, and Mr. Wafer $17.64. How much does he owe them all?

8. A farmer sold a horse for $109.50, four bales of cotton for $197.85, three hogsheads of sugar for $239, and a load of corn for $13.25. How much did he receive for all?

9. Henry paid $86.35 for a pony, $9.85 for a saddle, $3.25 for a bridle, and $17 for a gun. How much did he spend?

10. A lady bought a hat for $18.75, a parasol for $6.65, a fan for $3.48, and a pair of kid gloves for $2.39. How much did she pay for all?

11. A speculator bought a drove of horses for $3764.15, a drove of cattle for $2017.55, a drove of sheep for $620, and sold them at a profit of $784.65. How much did he receive for them?

12. I sold a house and lot for $1305, which was $960.50 less than cost. How much did they cost me?

SUBTRACTION

A wagon is loaded with hay. The wagon and hay together weigh 3281 pounds and the wagon alone weighs 1345 pounds. What is the weight of the hay?

The weight of the hay is the difference between 3281 pounds and 1345 pounds.

$$\begin{array}{r} 3281 \\ \underline{1345} \\ 1936 \end{array}$$

Can 5 ones be subtracted from 1 one?

Can 3 hundreds be subtracted from 2 hundreds?

Then think of 3281 as 2 thousand 12 hundreds 7 tens 11 ones, and say or think, "5 from 11, 6; 4 from 7, 3; 3 from 12, 9; 1 from 2, 1."

Check. Add the subtrahend and the remainder, thus: 6, 11; 1, 4, 8; 9, 12; 1, 2, 3.

Subtraction is the operation of finding the difference between two numbers.

The **subtrahend** is the number to be subtracted, and the **minuend** is the number from which the subtrahend is to be subtracted.

1. What is the sign of subtraction?
2. What is the result of subtraction called?
3 Can 4 wrens be subtracted from 7 doves? Why not?

Principles. *Only like numbers can be subtracted.*

Tell how the following may be subtracted:

1. 2 bushels less 5 pecks ; 3 wk. — 6 da.

2. 5 sixths less 2 thirds ; $\frac{3}{4} - \frac{1}{6}$.

The minuend is equal to the sum of the subtrahend and the difference or remainder.

3. Find the difference between 100 and 47.

4. Find the difference between 108 and 63.

5. Find the difference between 250 and 164.

6. Find the difference between 800 and 506.

7. Find the difference between 3671 and 451.

8. Find the difference between 5000 and 308.

9. A man paid $1675 for a lot and $6220 for a house. How much more did the house cost than the lot?

10. By rail it is 3745 miles from New York to San Francisco, and 2487 miles from New Orleans to San Francisco. How much farther is San Francisco from New York than from New Orleans?

11. In 1890 the population of a city was 10,378 and in 1900 it was 14,625. What was the increase in 10 years?

Subtract and check:

12.	3000	**13.**	5000	**14.**	7000	**15.**	9000	**16.**	8000
	285		647		391		8101		6038
17.	2111	**18.**	4000	**19.**	1000	**20.**	4321	**21.**	7060
	1887		89		99		1234		3281
22.	$187\frac{1}{2}$	**23.**	$907\frac{1}{3}$	**24.**	642	**25.**	$860\frac{1}{4}$	**26.**	$500\frac{1}{2}$
	$139\frac{1}{3}$		408		$346\frac{3}{4}$		$137\frac{1}{2}$		$42\frac{5}{6}$

From 6483 subtract 3927.

$$\begin{array}{r}6483\\ \underline{3927}\\ 2556\end{array}$$

Think of 3 as 13, think of 8 as 7, think of 4 as 14, think of 6 as 5, and write: 6, 5, 5, 2.

Check. Add the subtrahend and remainder, thus: 6, 13; 1, 6, 8; 5, 14; 1, 3, 6.

Subtract and check:

1.	3275	**2.**	4162	**3.**	5391	**4.**	7463	**5.**	9547
	1829		2538		1684		6828		4719
6.	8312	**7.**	7645	**8.**	3943	**9.**	6114	**10.**	8352
	5467		3678		2875		5648		7987
11.	3006	**12.**	5003	**13.**	4014	**14.**	8017	**15.**	9060
	1238		3567		2065		7308		8199
16.	2360	**17.**	4030	**18.**	5120	**19.**	8211	**20.**	9000
	687		923		875		79		301

21. 362 − 57

22. 521 − 245

23. 6304 − 2725

24. 500 − 46

25. 815 − 726

26. 7003 − 2009

27. 470 − 97

28. 706 − 418

29. 8117 − 5222

30. 615 − 68

31. 200 − 173

32. 6030 − 4177

33. 377 − 88

34. 803 − 609

35. 5202 − 3066

36. 902 − 15

37. 2005 − 76

38. 4091 − 2803

39. 707 − 58

40. 3136 − 69

41. 9000 − 3456

Write the right numbers in the blanks:

42. 851 + ( ) = 2000.

43. 5813 − ( ) = 3648.

44. $96\frac{1}{2}$ + ( ) = $671\frac{5}{6}$.

45. $938\frac{1}{4}$ − ( ) = $419\frac{2}{3}$.

1. Frank wrote 143 words, but misspelled 17 of them. How many did he spell correctly?

2. From a drove of 372 cattle 185 were sold. How many cattle were left?

3. A man owning 2406 acres of land sold 875 acres. How many acres did he have left?

4. The sum of two numbers is 1500, and one of the numbers is 966. What is the other number?

5. A man has $2375. How much more does he need to pay a debt of $3032?

6. A newspaper has 4731 subscribers, 856 of whom live in the country. How many live in the city?

7. A man bought a lot for $3578, and sold it for $5125. How much did he gain?

8. How much is saved in a year by a man whose salary is $2225, and whose expenses are $1348?

9. One bale of cotton weighs 517 pounds, and another 487 pounds. Find the difference between their weights.

10. How many bricks are 6485 bricks less 3709 bricks?

11. How many apples are 2013 apples less 1522 apples?

12. How many houses are 4000 houses less 2987 houses?

13. The population of a village was 6836, and ten years later it was 9843. What was the increase?

14. The sum of 748 and another number is 2419. Find the other number.

15. Three thousand two hundred nine + — = 6137.

16. Two thousand one hundred eleven + — = 7010.

17. Six thousand four hundred sixty + — = 9235.

From $625 subtract $235.75.

Write the numbers so that one of the points shall fall under the other, annexing two naughts to the minuend to supply the vacant places of cents.

$$\begin{array}{r} \$625.00 \\ 235.75 \\ \hline \$389.25 \end{array}$$

1. A man gave $187 for a horse and $69.35 for a buggy. How much more did the horse cost than the buggy?

2. A farmer bought a wagon for $113, and gave in exchange a cow worth $43.75, and the balance in cash. How much cash was required?

3. How many dollars are $980 – $435 – $386?

4. The sum of three numbers is 1160. The first number is 384 and the second is 571. Find the third number.

5. A boy had 769 cents, of which he gave his sister 263 cents and his mother 378 cents. How many cents had he left?

6. A man starts on a journey of 583 miles. After traveling 260 miles, 173 miles, and 95 miles, how far has he to go?

7. A man owes $2000. If he pays $520, then $763.84, and then $397, how much will he still owe?

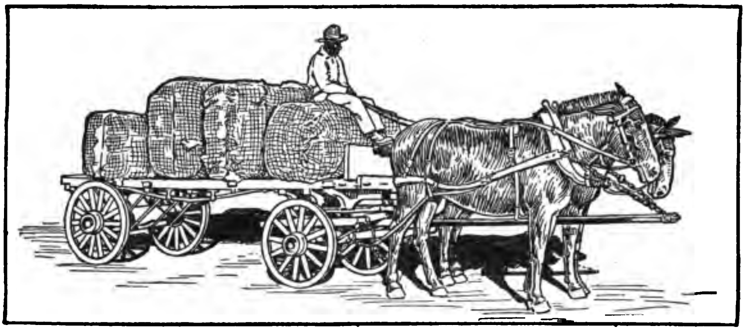
8. A man having $1768 on deposit gave a check for $175 to A, one for $238.25 to B, and one for $369.50 to C. How much money was left on deposit?

9. A farmer raised 3750 bu. of wheat, corn, and barley, of which 1521 bu. were wheat and 1038 bu. were corn. How much barley did he raise?

10. A man paid $5270 for a house and $1835 for improving it. If he sells the house for $7623, what will be his gain?

11. A and B are 2538 ft. apart. If A goes toward B 379 ft., and B goes toward A 685 ft., how far apart will they then be?

MULTIPLICATION



A wagon is loaded with 4 bales of cotton and each bale weighs 487 pounds. Find the weight of the load.

Think "4 × 7 are 28." Write 8 and carry 2.

Then think "4 × 8 are 32 and 2 are 34." Write 4 and carry 3.

Then think "4 × 4 are 16 and 3 are 19." Write 19.

The weight of the load is 1948 pounds.

MULTIPLICATION

$$\begin{array}{r} 487 \\ 4 \\ \hline 1948 \end{array}$$

ADDITION

$$\begin{array}{r} 487 \\ 487 \\ 487 \\ 487 \\ \hline 1948 \end{array}$$

Complete: Multiplying 487 by 4 is taking 487 as many times as there are 1's in ——; and it is also a short way of adding the four equal numbers ——, ——, ——, and ——.

Multiplication is the operation of taking one number as many times as there are ones in another number, and it is also a short method of adding equal numbers.

The **multiplicand** is the number to be multiplied, and the **multiplier** is the number which shows how many times the multiplicand is to be taken.

What is the sign of multiplication?

What is the result of multiplication called?

The **factors** of a number are the numbers whose product is the given number.

Thus, 3 and 5 are the factors of 15.

A **concrete number** is a number that is applied to a particular object; as 3 days, 5 pigs, $7.

An **abstract number** is a number that is not applied to any particular object; as 3, 5, 7.

PRINCIPLES. *The multiplicand and product are like numbers.*

The multiplier is an abstract number.

The factors may be taken in any order.

Thus, 3 × 4 × 5 = 3 × 5 × 4 = 5 × 4 × 3.

Multiply, and check by addition:

1.	231	**2.**	342	**3.**	416	**4.**	524	**5.**	637	**6.**	830
	3		4		3		4		5		6
7.	312	**8.**	425	**9.**	234	**10.**	119	**11.**	123	**12.**	432
	2		3		4		5		6		7

13. 541 × 6 **14.** 467 × 7 **15.** 738 × 8 **16.** 832 × 9
17. 965 × 5 **18.** 766 × 8 **19.** 560 × 6 **20.** 807 × 8
21. 970 × 7 **22.** 604 × 9 **23.** 708 × 4 **24.** 909 × 7
25. 385 × 7 **26.** 463 × 8 **27.** 974 × 6 **28.** 73 × 4
29. 690 × 5 **30.** 508 × 7 **31.** 990 × 8 **32.** 97 × 5

33. Find the value of 7 horses at $186 each.

34. Find the value of 9 wagons at $147 each.

Multiply each of the following by 2; by 3; 4; 5:

1. 687
2. 5349
3. 62,807
4. 538,916
5. 451
6. 8167
7. 35,419
8. 472,068
9. 293
10. 7026
11. 78,693
12. 876,549

Multiply each of the following by 6; by 7; 8; 9:

13. 563,874
14. 6,278,597
15. 48,269,567
16. 837,296
17. 9,386,089
18. 76,399,805
19. 706,849
20. 8,679,008
21. 98,678,457

MARKET REPORT

Grapes, per crate,	$2.50	Apples, per bbl.,	$3.95
Oranges, per box,	$2.25	Raisins, per box,	$1.65
Lemons, per box,	$4.75	Cantaloupes, per box,	$4.80
Oysters, per bbl.,	$3.50	Pineapples, per crate,	$2.75
Pears, per bbl.,	$3.75	Peaches, per basket,	$1.35

(For multiplication of dollars and cents, see p. 114.)

From the above report find the cost of:

22. 7 crates of grapes and 6 boxes of raisins.

23. 8 boxes of lemons and 5 barrels of apples.

24. 9 barrels of pears and 4 boxes of cantaloupes.

25. 3 boxes of oranges and 7 crates of pineapples.

26. 8 barrels of oysters and 9 baskets of peaches.

27. Find the cost of 7 horses at $218 each and 9 mules at $195 each.

28. Find the value of 8¾ acres of land at $156 per acre.

29. Find the cost of 199 gal. milk at 9¢ a quart.

30. Find the product when the multiplicand is 52,879 and the multiplier 6.

1. In an orchard there are 8 rows of trees and 123 trees in each row. How many trees are there?

2. The average weight of 6 bales of cotton is 517 pounds. What is the weight of the six bales?

3. There are 640 acres in a square mile. How many acres are there in 9 square miles?

4. John walked 7 miles. How many yards did he walk, there being 1760 yards in a mile?

5. There are 32 gi. in 1 gal. How many gills are there in 9 gal.?

6. There are 64 pt. in 1 bu. How many pints are there in 8 bu.?

7. If there are 9 classes in school, and 47 pupils in each class, how many pupils are there in school?

8. How many days are there in 7 years, there being 365 days in 1 year?

9. A train has 7 coaches, and there are 57 passengers in each coach. How many passengers are there in all?

10. A man bought 86 sheep at $5 each and 175 pigs at $6 each. How much did he pay for all?

11. A train ran 3 hr. at 50 mi. an hour, 7 hr. at 47 mi. an hour, and 9 hr. at 32 mi. an hour. How far did it run?

12. In a pamphlet of 9 pages there are 29 lines to the page and 9 words to the line. How many words are there in the pamphlet?

13. Sound travels about 1135 feet per second. If you see a flash of lightning 7 seconds before you hear the thunder, how far is the cloud from you?

Multiplying by tens and hundreds.

1. How many are 10 × one? 10 × ten? 10 × a hundred?

2. Multiply 67 by 10.

$$\begin{array}{ll} 10 \times 7 \text{ ones} = 7 \text{ tens} & \text{6 tens 7 ones} = 67 \\ 10 \times 6 \textit{ tens} = 6 \textit{ hundreds} & \underline{\qquad\qquad 10 = \ 10} \\ 10 \times (\text{6 tens 7 ones}) = \text{6 hundreds 7 tens} = & \text{6 hundreds 7 tens} = 670 \end{array}$$

3. Multiply:

8 by 10; 24 by 10; 50 by 10; 643 by 10.

Annexing a 0 *to the right of a number multiplies it by* **10.**

4. Multiply 8 by 100; 64 by 100; 137 by 100.

Give an easy rule for multiplying an integer by 100.

Complete:

5. 68 × 10 = ——

6. 53 × 100 = ——

7. 9 × 100 = ——

8. 205 × 10 = ——

9. $5 = —— dimes

10. 7 dimes = —— cents

11. $7 = —— cents

12. 8 cents = —— mills

13. Multiply 230 by 40.

If one or both factors end with 0's, neglect the 0's in multiplying, and annex to the product as many 0's as have been neglected.

$$\begin{array}{r} 230 \\ \underline{40} \\ 9200 \end{array}$$

Multiply:

14. $\begin{array}{r} 360 \\ \underline{8} \end{array}$ **15.** $\begin{array}{r} 290 \\ \underline{7} \end{array}$ **16.** $\begin{array}{r} 510 \\ \underline{9} \end{array}$ **17.** $\begin{array}{r} 380 \\ \underline{20} \end{array}$ **18.** $\begin{array}{r} 600 \\ \underline{6} \end{array}$ **19.** $\begin{array}{r} 704 \\ \underline{80} \end{array}$

20. 160 × 70

21. 27 × 300

22. 1300 × 7

23. 285 × 80

24. 9 × 4000

25. 6 × 8000

Multiply 746 by 23.

$$\begin{array}{lr} 23 = 20 + 3 & 746 \\ & \underline{23} \\ 746 \times 3 = & 2238 \\ \underline{746 \times 20 =} & \underline{14920} \\ 746 \times 23 = & 17158 \end{array} \qquad \begin{array}{r} 746 \\ \underline{23} \\ 2238 \\ \underline{1492} \\ 17158 \end{array}$$

14,920 = 1492 tens. In practice, the work is done as shown at the right.

The products obtained by multiplying the multiplicand by the ones, tens, etc., of the multiplier are called **partial products.**

Note that the right-hand figure of each partial product is placed under that figure of the multiplier which produces it.

Check. To prove the work, multiply the multiplier by the multiplicand.

Multiply and prove:

1. $\begin{array}{r}37\\ \underline{24}\end{array}$	**2.** $\begin{array}{r}28\\ \underline{35}\end{array}$	**3.** $\begin{array}{r}43\\ \underline{46}\end{array}$	**4.** $\begin{array}{r}56\\ \underline{57}\end{array}$	**5.** $\begin{array}{r}65\\ \underline{68}\end{array}$	**6.** $\begin{array}{r}78\\ \underline{83}\end{array}$
7. $\begin{array}{r}238\\ \underline{47}\end{array}$	**8.** $\begin{array}{r}496\\ \underline{82}\end{array}$	**9.** $\begin{array}{r}457\\ \underline{35}\end{array}$	**10.** $\begin{array}{r}243\\ \underline{61}\end{array}$	**11.** $\begin{array}{r}268\\ \underline{74}\end{array}$	**12.** $\begin{array}{r}593\\ \underline{59}\end{array}$

13. 48 × 17	**14.** 165 × 36	**15.** 248 × 319
16. 53 × 41	**17.** 374 × 29	**18.** 365 × 437
19. 96 × 53	**20.** 587 × 65	**21.** 709 × 576
22. 39 × 78	**23.** 428 × 99	**24.** 578 × 784
25. 67 × 86	**26.** 294 × 58	**27.** 697 × 879
28. 76 × 88	**29.** 685 × 75	**30.** 806 × 958
31. 64 × 35	**32.** 204 × 50	**33.** 521 × 420
34. 26 × 48	**35.** 569 × 75	**36.** 600 × 702
37. 75 × 16	**38.** 807 × 98	**39.** 900 × 480
40. 92 × 67	**41.** 670 × 80	**42.** 678 × 789

1. A hogshead holds 63 gallons. How many gallons will 49 hogsheads hold?

2. The average weight of 45 bales of cotton is 493 pounds. How much do the 45 bales weigh?

3 How much will 27 horses cost at $140 each?

4. There are 365 days in a common year. How many days are there in 32 common years?

5. How much will 136 tables cost, at $18 per table?

6. When corn is worth 54¢ a bushel, how much will 36 bushels cost?

7. A load of 12 bales of cotton, each bale weighing 490 pounds, was sold at 9¢ a pound. How much was received for the load?

8. A common clock makes 156 strokes every day. How many strokes will it make in a year of 365 days?

9. A jeweler bought 4 dozen rings at $18 each, and 3 dozen watches at $35 each. How much did they cost him?

10. A farmer raised 19 acres of corn, which yielded 23 bushels to the acre. He sold it for 56¢ a bushel. How much did he receive?

11. A man paid 24¢ each for 17 chickens, and 9¢ each for 3 dozen birds. How much did he pay all together?

12. When corn is 68¢ a bushel, and wheat is 94¢ a bushel, how much more will 76 bushels of corn cost than 38 bushels of wheat?

13. A man bought 287 cows at $26 each, and gave in exchange 48 mules at $134 each. How much does he still owe?

14. A jobber bought 7 car loads of boxes, each containing 138 boxes at 29¢ a box. How much did they cost him?

DIVISION

Mary has 24 apples and wishes to put them in equal piles of 8 apples. How many piles will there be?

The number of piles will be the number of times 24 apples contain 8 apples, which is 3.

That is, 24 apples ÷ 8 apples = 3.

Suppose Mary should wish to put her 24 apples in 4 equal piles. How many would there be in each pile?

The number in each pile would be $\frac{1}{4}$ of 24 apples, which is 6 apples.

That is, 24 apples ÷ 4 = 6 apples.

Division is the operation of finding how many times one number is contained in another number, or of finding one of the equal parts of a number.

The **dividend** is the number to be divided, and the **divisor** is the number by which the dividend is to be divided.

What is the sign of division?

What is the result of division called?

When a part of the dividend is left after the division is performed, it is called the **remainder**. The remainder should be written over the divisor and annexed to the quotient.

PRINCIPLE. *The dividend is equal to the product of the divisor and quotient.*

Thus, $72 \div 9 = 8$, and $8 \times 9 = 72$;
$53 \div 8 = 6\frac{5}{8}$, and $6\frac{5}{8} \times 8 = 53$.

Write the right numbers in the blanks:

$(\quad) \div 6 = 15$; $(\quad) \div 6 = 5\frac{1}{3}$.

When the dividend and the divisor are like numbers, the quotient is an abstract number.

SHORT DIVISION

If 936 chestnuts are divided equally among 3 boys, how many chestnuts will each boy receive?

The number each boy will receive is $\frac{1}{3}$ of 936, which is found by dividing 936 by 3.

3)9 hundreds 3 tens 6 ones 3)936
3 hundreds 1 ten 2 ones 312

Divide 1468 by 2.

2)14 hundreds 6 tens 8 ones 2)1468
7 hundreds 3 tens 4 ones 734

Divide:

1. 3)639 **2.** 2)824 **3.** 2)482 **4.** 4)328 **5.** 5)305

6. 4)844 **7.** 3)936 **8.** 2)842 **9.** 6)366 **10.** 7)497

11. 2)4682 **12.** 3)1896 **13.** 4)2448 **14.** 6)3264 **15.** 4)3684

16. If 3 books cost 63¢, how much will 1 book cost?

17. If 2 lots cost $248, how much will 1 lot cost?

18. What is the average rate per hour of a train which runs 96 miles in 3 hours?

19. A father divided $8484 equally among 4 boys. How much money did each boy receive?

20. In 4628 pints there are —— quarts.
21. In 6224 pints there are —— quarts.
22. In 222,677 days there are —— weeks.
23. In 186,339 feet there are —— yards.
24. In 96,888 quarts there are —— pecks.

Divide 267 by 3.

3)26 tens 7 ones
8 tens 9 ones

3)267
89

26 tens ÷ 3 = 8 tens, with 2 tens undivided; write 8 in the tens' place below; 2 tens and 7 ones = 27 ones; 27 ones ÷ 3 = 9 ones; write 9 below.

Divide 1756 by 4.

4)17 hundreds 5 tens 6 ones
4 hundreds 3 tens 9 ones

4)1756
439

17 hundreds ÷ 4 = 4 hundreds, with 1 hundred undivided; write 4 in the hundreds' place of the quotient.

1 hundred and 5 tens = 15 tens; 15 tens ÷ 4 = 3 tens, with 3 tens undivided; write 3 in the tens' place of the quotient.

3 tens and 6 ones = 36 ones; 36 ones ÷ 4 = 9 ones.

Check. **Multiply the quotient by the divisor.**

Divide:

1. 3)228
2. 4)276
3. 5)185
4. 2)738
5. 6)348
6. 7)343

7. 4)860
8. 5)405
9. 6)516
10. 7)889
11. 8)992
12. 9)765

13. 3)1437
14. 4)3660
15. 5)8195
16. 6)7656
17. 7)9198

18. 33,095 ÷ 5
19. 28,308 ÷ 6
20. 60,718 ÷ 7
21. 67,167 ÷ 9
22. 49,304 ÷ 8
23. 33,822 ÷ 9
24. 27,072 ÷ 6
25. 78,365 ÷ 7
26. 85,878 ÷ 9

LONG DIVISION

In beginning Long Division, it is advisable that pupils should first learn the *form* of the process. This is best done by means of simple examples worked in the long division form.

Notice that the quotient is written above the dividend instead of below, as in short division.

Divide 37,465 by 5.

$$\begin{array}{rcr} 35000 \div 5 & = & 7000 \\ 2000 \div 5 & = & 400 \\ 450 \div 5 & = & 90 \\ \underline{15} \div 5 & = & \underline{3} \\ 37465 \div 5 & = & 7493 \end{array} \qquad \begin{array}{r} 7493 \\ 5\overline{)37465} \\ 35 \\ \hline 24 \\ 20 \\ \hline 46 \\ 45 \\ \hline 15 \\ \underline{15} \end{array}$$

Find:

1. 536 ÷ 4
2. 5)2875
3. 6)15,372
4. 717 ÷ 3
5. 8)4384
6. 7)22,155
7. 602 ÷ 7
8. 6)5112
9. 9)64,062

The chief difficulties that pupils encounter in long division are (1) finding correctly and readily the partial quotients, and (2) manipulating large numbers. The mastery of these difficulties is mainly the result of the experience derived from carefully graduated practice. The first step in this gradation, after the form has been learned, is the solution of examples in which the partial quotient is found by dividing the first one or two figures of the dividend by the first figure of the divisor. All the examples on the next page are of this character.

Divide 552 by 23.

5 ÷ 2 = 2 quo., 1 rem.
23 × 2 = 46
9 ÷ 2 = 4 quo., 1 rem.
23 × 4 = 92

$$\begin{array}{r} 24\\ 23\overline{)552}\\ \underline{46}\\ 92\\ \underline{92}\end{array}$$

Approximately, 55 tens ÷ 23 = 5 tens ÷ 2 = 2 tens, with 1 ten undivided. Write 2 in the tens' place of the quotient.

23 × 2 tens = 46 tens; 55 tens − 46 tens = 9 tens; 9 tens and 2 ones = 92 ones.

Approximately, 92 ones ÷ 23 = 9 ones ÷ 2 = 4 ones, with 1 one undivided. Write 4 in the ones' place of the quotient. 23 × 4 ones = 92 ones; 92 − 92 = 0.

Hence, 552 ÷ 23 = 24.

Check. 23 × 24 = 552.

Divide and check:

1. 748 ÷ 22
2. 943 ÷ 23
3. 803 ÷ 73
4. 768 ÷ 24
5. 736 ÷ 32
6. 770 ÷ 35
7. 726 ÷ 33
8. 504 ÷ 24
9. 576 ÷ 24
10. 756 ÷ 36
11. 714 ÷ 21
12. 992 ÷ 31

13. 1462 ÷ 43

14 ÷ 4 = 3, with 2 undivided.
43 × 3 = 129
17 ÷ 4 = 4, with 1 undivided.
43 × 4 = 172

$$\begin{array}{l} 43)1462(34\\ \underline{129}\\ 172\\ \underline{172}\end{array}$$

14. 1170 ÷ 45
15. 1344 ÷ 56
16. 2170 ÷ 62
17. 1472 ÷ 32
18. 2550 ÷ 75
19. 3528 ÷ 84
20. 2576 ÷ 92
21. 2418 ÷ 78
22. 2278 ÷ 67
23. 2639 ÷ 91
24. 2394 ÷ 57
25. 5376 ÷ 84
26. 7626 ÷ 82
27. 2666 ÷ 43
28. 2652 ÷ 78
29. 6716 ÷ 92
30. 6674 ÷ 71
31. 6806 ÷ 83
32. 8740 ÷ 95
33. 5518 ÷ 89
34. 8658 ÷ 78

In the preceding examples the correct quotient figures were found by dividing the first one or two figures of the dividend by the first figure of the divisor. But it often happens that the figure thus found is too large.

Divide 1786 by 38.

$17 \div 3 = 5$, with 2 undivided; $38 \times 5 = 190$. But 190 is greater than 178, which shows that the first quotient figure is less than 5. Try 4. $38 \times 4 = 152$; $178 - 152 = 26$.

$26 \div 3 = 8$, with 2 undivided; $38 \times 8 = 304$. But 304 is greater than 266, which shows that the second quotient figure is less than 8. Try 7. $38 \times 7 = 266$.

Check. $38 \times 47 = 1786$.

$$\begin{array}{r} 47 \\ 38\overline{)1786} \\ \underline{152} \\ 266 \\ \underline{266} \end{array}$$

Divide and check:

1. 1692 ÷ 47
2. 2291 ÷ 29
3. 3675 ÷ 75
4. 1508 ÷ 58
5. 1911 ÷ 49
6. 2744 ÷ 56
7. 4002 ÷ 69
8. 5104 ÷ 88
9. 3395 ÷ 35
10. 2784 ÷ 96
11. 1482 ÷ 78
12. 6633 ÷ 67
13. 4005 ÷ 89
14. 1292 ÷ 19
15. 5626 ÷ 97
16. 1728 ÷ 216
17. 11,908 ÷ 458
18. 2135 ÷ 305
19. 18,544 ÷ 976
20. 2568 ÷ 428
21. 26,705 ÷ 763
22. 3934 ÷ 562
23. 38,554 ÷ 521
24. 3915 ÷ 783
25. 50,112 ÷ 864
26. 66,168 ÷ 72
27. 21,825 ÷ 873
28. 28,188 ÷ 87
29. 58,608 ÷ 792
30. 53,728 ÷ 92
31. 68,211 ÷ 689
32. 37,185 ÷ 67
33. 54,714 ÷ 829
34. 53,132 ÷ 74
35. 78,921 ÷ 999
36. 43,089 ÷ 53
37. 497,553 ÷ 87
38. 35,811 ÷ 69
39. 312,588 ÷ 76

When there are 0's in the quotient.

Divide 10,530 by 26.

When we subtract 104 from 105, and annex 3 to the remainder, we find that the partial dividend, 13, is less than the divisor. So we put 0 in the tens' place of the quotient, and to 13 annex the next figure, 0, for the new partial quotient.

```
26)10530(405
   104
   ───
     130
     130
     ───
```

Divide 222,296 by 37.

Here 222 − 222 = 0. We bring down the next dividend figure, 2. It is less than the divisor, and we write 0 in the quotient. We bring down the next dividend figure, 9, and find that 29 is too small, therefore we put another 0 in the quotient. Bringing down another dividend figure, we find that 296 contains the divisor.

```
37)222296(6008
   222
   ───
      296
      296
      ───
```

Find:

1. 7675 ÷ 25	2. 112,392 ÷ 56
3. 8987 ÷ 43	4. 279,465 ÷ 93
5. 9624 ÷ 24	6. 348,406 ÷ 58

7. At $25 an acre, how many acres of land can be bought for $2700?

8. A bushel of corn weighs 56 pounds. How many bushels are there in 11,480 pounds of corn?

9. How many times is 65 contained in 460,200?

10. A wheel rolls 13 ft. in one rotation. How many times will it rotate in rolling 13,078 ft.?

11. If a regiment of soldiers contains 1128 men, how many regiments would 119,568 men make?

12. How many bushels of oats are there in 192,256 lb., there being 32 lb. to the bushel?

Dividing by 10, 100, 1000, etc.

Divide 1625 by 100.

$$\begin{array}{r} 16 \\ 100\overline{)1625} \\ \underline{100} \\ 625 \\ \underline{600} \\ 25 \end{array}$$

Dividing according to the rule of Long Division, we find the quotient 16 and the remainder 25.

This answer could have been obtained by cutting off the last two figures (25) of the dividend for the remainder, and taking the rest of the dividend for the quotient. Thus, 16 quo., 25 rem.

1. Divide 78 by 10. *Ans.* 7 | 8; or 7 quo., 8 rem.

2. Divide 4509 by 1000. *Ans.* 4 | 509; or 4 quo., 509 rem.

Cut off for a remainder as many figures as there are naughts in the divisor.

Find the quotient and the remainder:

3. 7695 ÷ 10 ✓
4. 65,841 ÷ 100
5. 397 ÷ 100
6. 3719 ÷ 1000
7. 3007 ÷ 10
8. 80,007 ÷ 100
9. 804 ÷ 100
10. 1101 ÷ 1000

11. Divide 43 by 10; divide 471 by 100.

12. There are 10 dimes in one dollar. How many dollars are there in 40 dimes? in 260 dimes? in 500 dimes?

13. A drover having $3254, bought horses at $100 each. How many horses did he buy, and how many dollars had he left?

14. A dealer has 5895 cigars, and wishes to put them in boxes of 100 cigars each. How many boxes does he need, and how many cigars will he have left over?

Dividing when the divisor ends with 0's.

Divide 73,153 by 2700.

Cut off the ciphers from the divisor, and also cut off the same number of figures from the right of the dividend; divide the remaining figures of the dividend by the remaining figures of the divisor, and to the remainder, if any, annex the figures cut off from the dividend for a true remainder.

```
           27 quo.
27 | 00)731 | 53
        54
        191
        189
          253 rem.
```

Find the quotient and remainder:

1. 37,657 ÷ 50
2. 63,242 ÷ 3500
3. 7593 ÷ 900
4. 71,831 ÷ 6400
5. 43,787 ÷ 600
6. 93,045 ÷ 17,000
7. 35,016 ÷ 700
8. 184,973 ÷ 23,000

9. If 40 barrels of molasses cost $480, what is the price of 1 barrel?

10. A farmer sold 600 acres of land for $7800. How much was that per acre?

11. A merchant sold 8000 yards of cloth for $18,400. How much was that per yard?

12. John and Henry gather 6275 nuts, and desire to put them in sacks containing 290 nuts each. How many sacks do they need, and how many nuts will be left over?

13. If 250 bales of cotton weigh 126,000 pounds, what is the average weight for a bale?

14. How many hogsheads of sugar will it take to weigh 281,520 pounds, if each hogshead weighs 1360 pounds?

1. How many cows can be bought for $19,608, at $43 a head?

2. At what price per head must I sell 259 sheep to receive $1036?

3. If 25 bales of cotton weigh 12,400 pounds, what is the average weight of the bales?

4. How many hours will it take a locomotive to run 800 miles, at the rate of 32 miles per hour?

5. If 1 hogshead of sugar weighs 1450 pounds, how many hogsheads will it take to weigh 17,400 pounds?

6. A drover paid $13,335 for a number of horses, the average price per horse being $127. How many horses did he buy?

7. The length of the tire of a wheel is 56 inches. How many times will the wheel revolve in rolling a distance of 7504 inches?

8. How many bales, each weighing 475 pounds, can be made of 93,100 pounds of cotton?

9. A grocer had 3888 eggs in 54 boxes. If there were the same number in each box, how many dozen were in each?

10. How many pounds are there in 6000 ounces?

11. If $11,220 is divided equally among 17 children, how much will each receive?

12. A pipe discharges 56 gallons in an hour. In how many days will it discharge 40,320 gallons?

13. A farmer sold 27 calves at the rate of 16 for $240. How much did he receive for them?

14. One barrel of flour weighs 196 pounds. How many barrels of flour will weigh 16,464 pounds?

Complete 655 pt. = —— gal. —— qt. —— pt.

Solution. Since 2 pt. = 1 qt., there are as many quarts in 655 pt. as 2 pt. is contained times in 655 pt., or 327 qt. and 1 pt. over.

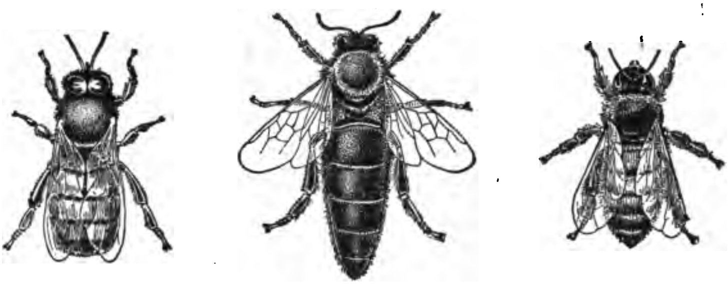
Since 4 qt. = 1 gal., there are as many gallons in 327 qt. as 4 qt. is contained times in 327 qt., or 81 gal. and 3 qt. over.

Therefore 655 pt. = 81 gal. 3 qt. 1 pt.

Complete:

1. 735 pt. = —— gal. —— qt. —— pt.
2. 811 pt. = —— gal. —— qt. —— pt.
3. 1203 qt. = —— bu. —— pk. —— qt.
4. 1361 qt. = —— bu. —— pk. —— qt.
5. 1101 in. = —— yd. —— ft. —— in.
6. 1623 in. = —— yd. —— ft. —— in.
7. 2007 pt. = —— gal. —— qt. —— pt.
8. 2316 pt. = —— gal. —— qt. —— pt.
9. 793 pt. = —— gal. —— qt. —— pt.
10. 2123 qt. = —— bu. —— pk. —— qt.
11. 1860 in. = —— yd. —— ft. —— in.
12. 2937 pt. = —— gal. —— qt. —— pt.
13. At $9 each, —— guns can be bought for $29,250.
14. At $8 each, —— desks can be bought for $21,240.
15. At $6 each, —— rugs can be bought for $8700.
16. At $4 each, —— hats can be bought for $27,156.
17. At $5 a yard, it will take —— yards of silk to amount to $37,295.
18. A man received $4734 for some land, which he sold at $6 per acre. He sold —— acres.
19. There are 12,320 yards in 7 miles. In 1 mile there are —— yards.

HONEY BEES



Drone **Queen** **Worker**

Bees are "social insects," and live in colonies, each colony occupying a hive, or perhaps a hollow tree in the woods.

There are three kinds of bees in each colony, the **queen**, the **drones**, and the **workers**. The queen lays all the eggs which produce the young bees. The drones, or males, are large, and do no work. The workers do all the work, such as gathering the honey, building the comb, taking care of the "baby bees," repelling enemies, and "keeping the house clean."

The queen can lay several hundred eggs a day, sometimes as many as a thousand in twenty-four hours. The eggs hatch in about 3 days into small, helpless, wormlike larvæ, and in about 18 days the larvæ grow into full-grown bees.

When a hive becomes overstocked a new colony is sent out under the direction of a queen. This is called **swarming**.

Bees are highly prized for the valuable **wax** and delicious honey which they produce, and it has been said of them, "They are among the few kinds of laborers that feed and clothe themselves and pay their own doctors' bills."

The **gram** and the **centigram** are small weights used in weighing very light things or substances.

100 centigrams = 1 gram (100 cg. = 1 g.).
450 grams (about) = 1 pound (450 g. = 1 lb. Av.).

1. How many centigrams are there in a pound?

2. How many grams are there in an ounce?

3. If a worker bee carries one centigram of honey from the flowers to the hive at each trip, how many trips would it have to make to gather a gram of honey?

4. How many trips (under the same conditions) would each of 100 bees have to make to gather a pound of honey all together?

5. If each trip requires 10 minutes, how many minutes would it take 500 bees to gather a pound of honey?

6. Under the same conditions, how many hours would it take 300 bees to gather a pound of honey?

7. If a colony of bees produces 48 lb. of honey and 5 lb. of wax during a season, and the honey sells at 14¢ a pound, and the wax at 33¢ a pound, what is the value of the wax and honey?

8. What would be the value of the wax and honey from an apiary of 73 hives, under the conditions given in the preceding problem?

9. An apiarist has 256 hives, and each hive produces, on an average, $46\frac{3}{4}$ lb. of honey and $4\frac{5}{8}$ lb. of wax, per season. If he sells the honey at 12¢ a pound and the wax at 40¢ a pound, what will be his total receipts per season?

10. If there are about 120,000 bees in 8 colonies, find the average number of bees in a colony.

11. A certain worker bee was 18 days in the larval state and lived $3\frac{1}{2}$ times as long as this. How long did it live?

12. If a man has 1 hive of bees the first year, 2 hives the second year, and so on, doubling the number each year, how many hives would he have in 8 years?

FRACTIONS

1. Read $\frac{5}{8}$. Which are the terms?

2. In $\frac{5}{8}$ which is the numerator? the denominator?

3. I have an apple and wish to take $\frac{5}{8}$ of it. What is the first thing to be done? the next thing?

4. What, then, does the denominator show? the numerator?

5. Is $\frac{5}{8}$ the same as 5 eighths? What, then, is the *part name* of $\frac{5}{8}$? of $\frac{3}{4}$? $\frac{9}{10}$?

A **fraction** is one or more of the equal parts of a single thing.

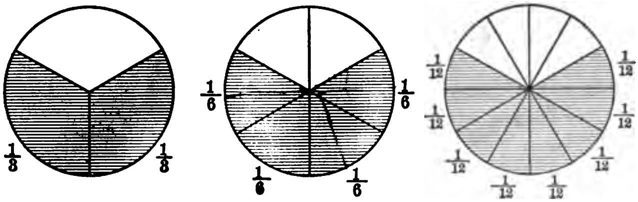
A **common fraction** is expressed by two numbers called **terms**, one (the **numerator**) written above, and the other (the **denominator**) below a horizontal line.

The denominator *names* and the numerator *numbers* the parts expressed by the fraction.

A **proper fraction** is one whose numerator is less than its denominator.

REDUCTION

Reducing to higher terms.



Show by this picture that dividing anything, as a circle, into 3 equal parts, and taking 2 of the parts, gets the same portion of it as dividing it into 6 equal parts and taking 4 of the parts, or dividing it into 12 equal parts and taking 8 of the parts.

6

That is, $\frac{2}{3} = \frac{4}{6} = \frac{8}{12}$.

Hence, complete:

$$\frac{2}{3} = \frac{4}{6} = \frac{2 \times 2}{— \times 3} = \frac{8}{12} = \frac{4 \times 2}{— \times 3}.$$

Multiplying both terms of a fraction by the same number does not change the value of the fraction.

Let each pupil cut a disk of paper into fractional parts, as shown in the preceding picture. It is advisable to use pictures of squares, rectangles, and lines, in illustrating fractions, and the pupil should be taught how to divide them into equal parts.

Reduce $\frac{5}{6}$ to 18ths.

To make the denominator 18, 6 must be multiplied by 3; multiplying both terms by 3 gives $\frac{15}{18}$.

$$18 \div 6 = 3$$
$$\frac{3 \times 5}{3 \times 6} = \frac{15}{18}$$

Reduce $\frac{3}{4}$ to 16ths.

To make the denominator 16, 4 must be multiplied by 4; multiplying both terms by 4 gives $\frac{12}{16}$.

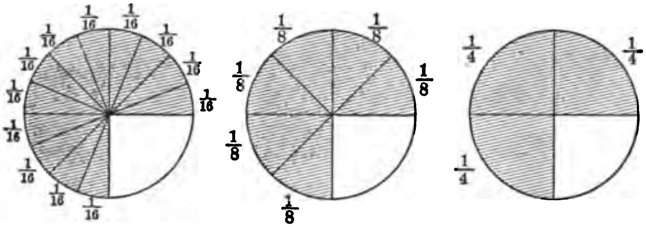
$$16 \div 4 = 4$$
$$\frac{4 \times 3}{4 \times 4} = \frac{12}{16}$$

1. Reduce $\frac{1}{2}$ to 6ths.
2. Reduce $\frac{2}{3}$ to 18ths.
3. Reduce $\frac{2}{3}$ to 9ths.
4. Reduce $\frac{3}{8}$ to 24ths.
5. Reduce $\frac{1}{4}$ to 8ths.
6. Reduce $\frac{2}{3}$ to 15ths.
7. Reduce $\frac{3}{4}$ to 8ths.
8. Reduce $\frac{5}{9}$ to 36ths.

Reduce:

9. $\frac{3}{4}$ to 12ths.
10. $\frac{5}{8}$ to 32ds.
11. $\frac{7}{12}$ to 360ths.
12. $\frac{4}{5}$ to 10ths.
13. $\frac{3}{7}$ to 42ds.
14. $\frac{5}{18}$ to 540ths.
15. $\frac{7}{9}$ to 18ths.
16. $\frac{4}{9}$ to 72ds.
17. $\frac{8}{13}$ to 455ths.
18. $\frac{1}{2}$ and $\frac{2}{3}$ to 12ths.
19. $\frac{5}{8}$ and $\frac{7}{12}$ to 24ths.
20. $\frac{3}{4}$ and $\frac{7}{9}$ to 36ths.
21. $\frac{4}{9}$ and $\frac{11}{15}$ to 45ths.
22. $\frac{5}{6}$ and $\frac{3}{8}$ to 48ths.
23. $\frac{5}{6}$ and $\frac{13}{18}$ to 36ths.

Reducing to lowest terms.



Show by these circles that $\frac{12}{16} = \frac{6}{8} = \frac{3}{4}$.

Hence, complete : $\frac{12}{16} = \frac{12 \div 2}{16 \div \text{—}} = \frac{12 \div 4}{16 \div \text{—}}$.

Dividing both terms of a fraction by the same number does not change the value of the fraction.

1. Reduce $\frac{6}{9}$ to 3ds. ✓ 2. Reduce $\frac{12}{18}$ to 6ths.
3. Reduce $\frac{4}{6}$ to 3ds. 4. Reduce $\frac{9}{12}$ to 4ths.
5. Reduce $\frac{6}{8}$ to 4ths. 6. Reduce $\frac{18}{30}$ to 5ths.

A fraction is in its **lowest terms** when its terms have no common divisor.

7. Reduce $\frac{45}{75}$ to its lowest terms.

Dividing both terms of $\frac{45}{75}$ by 5 gives $\frac{9}{15}$, and dividing both terms of $\frac{9}{15}$ by 3 gives $\frac{3}{5}$, which is in its lowest terms.

$$\frac{45}{75} = \frac{9}{15} = \frac{3}{5}.$$

Reduce to lowest terms:

8. $\frac{9}{18}$; $\frac{25}{35}$ ✓ **9.** $\frac{12}{15}$; $\frac{21}{35}$ ✓ ✓ **10.** $\frac{105}{140}$; $\frac{256}{272}$
11. $\frac{27}{45}$; $\frac{48}{60}$ ✓ **12.** $\frac{32}{56}$; $\frac{42}{70}$ ✓ **13.** $\frac{144}{270}$; $\frac{196}{588}$
14. $\frac{28}{44}$; $\frac{34}{51}$ ✓ **15.** $\frac{42}{68}$; $\frac{60}{90}$ ✓ ✓ **16.** $\frac{195}{312}$; $\frac{486}{672}$
17. $\frac{6}{27}$; $\frac{15}{75}$ **18.** $\frac{39}{65}$; $\frac{51}{85}$ ✓ **19.** $\frac{117}{195}$; $\frac{357}{595}$

Reducing improper fractions to whole or mixed numbers.

$\frac{3}{2}$, $\frac{6}{6}$, $\frac{13}{9}$, $\frac{25}{10}$ are called improper fractions.

An **improper fraction** is a fraction whose numerator is equal to or greater than its denominator.

$4\frac{3}{5}$ is called a mixed number; it means $4 + \frac{3}{5}$.

A **mixed number** is a whole number and a fraction united.

Draw three equal circles, divide each into 4 equal parts, and show:

$$\frac{4}{4}=1;\ \frac{8}{4}=2;\ \frac{5}{4}=1\frac{1}{4};\ \frac{6}{4}=1\frac{1}{2};\ \frac{11}{4}=2\frac{3}{4}.$$

How many 1's are there in $\frac{7}{3}$?

Since 3 thirds equal 1, 7 thirds will equal as many 1's as 3 is contained times in 7; that is, $2\frac{1}{3}$.

An improper fraction is reduced to a whole or a mixed number by dividing the numerator by the denominator.

A fraction is an indicated division, the numerator being the dividend and the denominator the divisor.

Change to whole or to mixed numbers:

$\boxed{1.}$ $\frac{3}{2}$ 2. $\frac{8}{3}$ 3. $\frac{7}{5}$ 4. $\frac{12}{3}$ 5. $\frac{16}{6}$
6. $\frac{6}{2}$ 7. $\frac{9}{4}$ 8. $\frac{8}{2}$ 9. $\frac{15}{4}$ 10. $\frac{26}{8}$

Reduce to whole or to mixed numbers:

11. $\frac{7}{4}$; $\frac{19}{5}$ **12.** $\frac{48}{8}$; $\frac{125}{9}$ **13.** $\frac{163}{9}$; $\frac{720}{144}$
14. $\frac{9}{3}$; $\frac{21}{8}$ **15.** $\frac{72}{12}$; $\frac{345}{11}$ **16.** $\frac{271}{13}$; $\frac{509}{125}$
17. $\frac{8}{5}$; $\frac{35}{7}$ **18.** $\frac{45}{13}$; $\frac{460}{17}$ **19.** $\frac{348}{20}$; $\frac{855}{25}$
20. $\frac{6}{2}$; $\frac{48}{6}$ **21.** $\frac{90}{12}$; $\frac{264}{16}$ **22.** $\frac{100}{12}$; $\frac{780}{60}$.

Reducing mixed numbers to improper fractions.

Draw four circles, divide each into 4 equal parts, and by them show that $2\frac{1}{4} = \frac{9}{4}$; $3\frac{3}{4} = \frac{15}{4}$.

Reduce $2\frac{3}{5}$ to 5ths.

Since 1 = 5 fifths, 2 = 2 × 5 fifths or 10 fifths; and 10 fifths + 3 fifths = 13 fifths, or $\frac{13}{5}$.

$$\begin{array}{r} 5 \\ \times\, 2 \\ \hline 10 \end{array} \qquad \begin{array}{r} 10 \\ +3 \\ \hline 13 \end{array} \qquad \textit{Ans. } \tfrac{13}{5}.$$

A mixed number is reduced to an improper fraction by multiplying the whole number by the denominator of the fraction, adding the numerator to the product, and writing the sum over the denominator.

Reduce to improper fractions:

1. $2\frac{1}{2}$	*2.* $3\frac{1}{4}$	*3.* $5\frac{1}{6}$	*4.* $7\frac{3}{10}$	*5.* $9\frac{5}{6}$
6. $4\frac{1}{3}$	*7.* $6\frac{2}{3}$	*8.* $8\frac{1}{3}$	*9.* $3\frac{7}{11}$	*10.* $8\frac{8}{9}$

Reduce to improper fractions:

11. $4\frac{1}{3}$; $7\frac{1}{4}$	**12.** $10\frac{3}{4}$; $12\frac{1}{3}$	**13.** $21\frac{5}{6}$; $34\frac{7}{10}$
14. $5\frac{3}{5}$; $6\frac{2}{9}$	**15.** $16\frac{2}{3}$; $15\frac{3}{4}$	**16.** $16\frac{3}{8}$; $45\frac{3}{11}$
17. $8\frac{5}{6}$; $9\frac{3}{7}$	**18.** $18\frac{3}{5}$; $17\frac{7}{9}$	**19.** $28\frac{5}{7}$; $60\frac{17}{20}$

Reducing fractions to a common denominator.

Reduce $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{8}$ to 24ths.

Both terms of each fraction must be multiplied by such a number as will make its denominator 24.

Both terms of $\frac{3}{4}$ must be multiplied by 6 (24 ÷ 4), both terms of $\frac{5}{6}$ by 4 (24 ÷ 6), and both terms of $\frac{7}{8}$ by 3 (24 ÷ 8).

$$\frac{3}{4} = \frac{6 \times 3}{6 \times 4} = \frac{18}{24}$$

$$\frac{5}{6} = \frac{4 \times 5}{4 \times 6} = \frac{20}{24}$$

$$\frac{7}{8} = \frac{3 \times 7}{3 \times 8} = \frac{21}{24}$$

Reducing fractions to a common denominator is changing them to the same **part name.**

The common denominator may be any multiple of the given denominators, but it is advisable to use the **least common multiple** of the denominators, that is, the least number that all the denominators will exactly divide.

To find the least number that two or more numbers (say 3, 4, 9, 12) will divide, take the multiples of the greatest one (12), viz.: 12, 24, 36, etc., until one is found (36) which all will divide.

Thus, the least number divisible by 3, 6, 12 is 12; by 3, 6, 8, 12 is 2 × 12, or 24; by 4, 5, 8, 10 is 4 × 10, or 40; by 5, 6, 12, 15, 20 is 3 × 20, or 60.

Reduce to the least common denominator or common part name:

1. $\frac{1}{2}$ and $\frac{1}{4}$ 2. $\frac{1}{4}$ and $\frac{3}{8}$ 3. $\frac{3}{8}$ and $\frac{7}{12}$
4. $\frac{1}{3}$ and $\frac{1}{6}$ 5. $\frac{5}{9}$ and $\frac{2}{3}$ 6. $\frac{4}{5}$ and $\frac{8}{15}$
7. $\frac{2}{3}$ and $\frac{3}{4}$ 8. $\frac{4}{9}$ and $\frac{5}{6}$ 9. $\frac{7}{9}$ and $\frac{5}{12}$
10. $\frac{2}{3}$, $\frac{3}{4}$, and $\frac{5}{6}$ 11. $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{7}{18}$

Reduce to equivalent fractions having the least common denominator or common part name:

12. $\frac{5}{9}$ and $\frac{11}{12}$ **13.** $\frac{3}{4}$ and $\frac{7}{18}$ **14.** $\frac{5}{24}$ and $\frac{7}{18}$
15. $\frac{3}{8}$ and $\frac{7}{10}$ **16.** $\frac{7}{9}$ and $\frac{8}{15}$ **17.** $\frac{3}{16}$ and $\frac{11}{12}$
18. $\frac{5}{6}$ and $\frac{13}{21}$ **19.** $\frac{5}{8}$ and $\frac{11}{14}$ **20.** $\frac{7}{20}$ and $\frac{8}{15}$
21. $\frac{1}{2}$, $\frac{3}{5}$, and $\frac{2}{7}$ **22.** $\frac{1}{3}$, $\frac{1}{4}$, $\frac{3}{10}$, and $\frac{7}{12}$
23. $\frac{5}{6}$, $\frac{4}{9}$, and $\frac{7}{8}$ **24.** $\frac{1}{6}$, $\frac{3}{8}$, $\frac{5}{18}$, and $\frac{7}{16}$
25. $\frac{2}{3}$, $\frac{1}{6}$, and $\frac{3}{8}$ **26.** $\frac{5}{8}$, $\frac{4}{9}$, $\frac{7}{18}$, and $\frac{5}{36}$
27. $\frac{5}{8}$, $\frac{4}{5}$, and $\frac{5}{6}$ **28.** $\frac{2}{5}$, $\frac{4}{7}$, $\frac{3}{14}$, and $\frac{12}{35}$
29. $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{2}{3}$ **30.** $\frac{2}{7}$, $\frac{3}{8}$, $\frac{7}{16}$, and $\frac{3}{10}$

ADDITION AND SUBTRACTION OF FRACTIONS

Pupils should review or refer to pp. 92, 93, 120.

Find:

1. $\frac{3}{8}+\frac{4}{8}$ 2. $\frac{5}{6}-\frac{2}{6}$ 3. $\frac{1}{8}+\frac{5}{8}-\frac{3}{8}$
4. $\frac{4}{9}+\frac{2}{9}$ 5. $\frac{3}{4}-\frac{1}{4}$ 6. $\frac{3}{7}+\frac{6}{7}-\frac{2}{7}$

7. Find the sum of $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$.

$\frac{1}{2} = \frac{6}{12}$
$\frac{1}{3} = \frac{4}{12}$
$\frac{1}{4} = \frac{3}{12}$
Sum $= \frac{13}{12} = 1\frac{1}{12}$

The denominators of these fractions are not the same; that is, the things to be added have not the same *part name*. But they can be made the same by reducing the fractions to a common denominator, or to twelfths.

8. From $\frac{3}{4}$ subtract $\frac{2}{5}$.

$\frac{3}{4} = \frac{15}{20}$
$\frac{2}{5} = \frac{8}{20}$
Difference $= \frac{7}{20}$

The denominators of these fractions are not the same; that is, the things to be subtracted have not the same *part name*. But the *part name* can be made the same by reducing the fractions to a common denominator, or to twentieths.

Find the sum of:

9. $\frac{1}{2}$ and $\frac{1}{4}$ **10.** $\frac{1}{3}$ and $\frac{1}{9}$ **11.** $\frac{5}{6}$ and $\frac{7}{12}$
12. $\frac{1}{6}$ and $\frac{1}{3}$ **13.** $\frac{1}{2}$ and $\frac{1}{8}$ **14.** $\frac{3}{5}$ and $\frac{7}{10}$
15. $\frac{1}{2}$ and $\frac{1}{3}$ **16.** $\frac{2}{3}$ and $\frac{1}{4}$ **17.** $\frac{1}{3}$ and $\frac{4}{15}$

Find the value of:

18. $\frac{1}{2}-\frac{1}{4}$ **19.** $\frac{1}{2}-\frac{1}{3}$ **20.** $\frac{2}{3}-\frac{1}{12}$
21. $\frac{1}{8}-\frac{1}{9}$ **22.** $\frac{1}{3}-\frac{1}{5}$ **23.** $\frac{3}{5}-\frac{7}{20}$
24. $\frac{1}{2}-\frac{2}{5}$ **25.** $\frac{1}{4}-\frac{1}{6}$ **26.** $\frac{3}{8}-\frac{5}{24}$

Find the value of $2\frac{1}{3} + 4\frac{1}{4}$.

The sum of the fractions is $\frac{7}{12}$.
The sum of the whole numbers is 6.
The sum of $2\frac{1}{3}$ and $4\frac{1}{4}$ is $6 + \frac{7}{12} = 6\frac{7}{12}$.

$$\begin{array}{r} 2\frac{1}{3} = 2\frac{4}{12} \\ \underline{4\frac{1}{4} = 4\frac{3}{12}} \\ 6\frac{7}{12} \end{array}$$

Find the value of:

1. $1\frac{1}{2}+2\frac{1}{6}$ **2.** $2\frac{1}{2}+3\frac{1}{5}$ **3.** $3\frac{1}{9}+5\frac{7}{18}$
4. $3\frac{1}{3}+1\frac{1}{9}$ **5.** $5\frac{1}{4}+4\frac{1}{3}$ **6.** $8\frac{1}{4}+3\frac{5}{12}$
7. $6\frac{2}{3}+2\frac{1}{2}$

$\frac{2}{3} + \frac{1}{2} = \frac{4}{6} + \frac{3}{6} = \frac{7}{6} = 1\frac{1}{6}$.
$6 + 2 = 8$; $8 + 1\frac{1}{6} = 9\frac{1}{6}$.

$$\begin{array}{r} 6\frac{2}{3} = 6\frac{4}{6} \\ 2\frac{1}{2} = \underline{2\frac{3}{6}} \\ 9\frac{1}{6} \end{array}$$

8. $1\frac{3}{4}+2\frac{1}{2}$ **9.** $4\frac{1}{2}+3\frac{7}{8}$ **10.** $5\frac{3}{4}+8\frac{7}{12}$
11. $5\frac{3}{4}+2\frac{3}{8}$ **12.** $9\frac{2}{3}+1\frac{5}{6}$ **13.** $8\frac{5}{6}+6\frac{11}{12}$

14. Find the value of $7\frac{4}{5}-4\frac{2}{3}$.

$\frac{4}{5} - \frac{2}{3} = \frac{12}{15} - \frac{10}{15} = \frac{2}{15}$;
$7 - 4 = 3$; $3 + \frac{2}{15} = 3\frac{2}{15}$.

$$\begin{array}{r} 7\frac{4}{5}=7\frac{12}{15} \\ \underline{4\frac{2}{3}}=\underline{4\frac{10}{15}} \\ \text{Difference} =3\frac{2}{15} \end{array}$$

Find the value of:

15. $3\frac{1}{2}-1\frac{1}{3}$ **16.** $6\frac{1}{3}-\frac{1}{9}$ **17.** $7\frac{3}{4}-5\frac{1}{12}$
18. $4\frac{1}{2}-3\frac{1}{6}$ **19.** $8\frac{2}{3}-\frac{1}{4}$ **20.** $9\frac{4}{5}-2\frac{3}{10}$
21. $5\frac{1}{2}-5\frac{2}{5}$ **22.** $4\frac{3}{4}-\frac{2}{3}$ **23.** $3\frac{5}{8}-3\frac{7}{12}$
24. $8\frac{1}{2}-4\frac{2}{3}$

Since $\frac{4}{6}$ cannot be subtracted from $\frac{3}{6}$, 1 or $\frac{6}{6}$ is taken from the 8 and added to $\frac{3}{6}$, thus changing $8\frac{3}{6}$ to $7\frac{9}{6}$.

$$\begin{array}{r} 8\frac{1}{2} = 8\frac{3}{6} = 7\frac{9}{6} \\ \underline{4\frac{2}{3} = 4\frac{4}{6}} = \underline{4\frac{4}{6}} \\ \text{Difference} \doteq 3\frac{5}{6} \end{array}$$

Find the value of:

25. $3\frac{1}{4}-1\frac{1}{2}$ **26.** $5\frac{1}{2}-3\frac{3}{4}$ **27.** $9\frac{1}{2}-\frac{5}{8}$
28. $6\frac{1}{6}-5\frac{1}{2}$ **29.** $10-4\frac{1}{3}$ **30.** $16-\frac{3}{5}$
31. $20-3\frac{3}{4}$ **32.** $15-\frac{3}{10}$ **33.** $8\frac{1}{3}-\frac{3}{4}$

1. Frank has $\$\frac{1}{2}$ in one hand and $\$\frac{3}{4}$ in the other. How much has he in both hands?

2. Robert paid $\$2\frac{1}{5}$ for a hat and $\$1\frac{3}{4}$ for a cap. How much did he spend?

3. Henry walked $3\frac{1}{4}$ miles one day and $4\frac{3}{4}$ miles the next day. How far did he walk in both days?

4. Mary bought $4\frac{1}{2}$ yards of blue ribbon and $3\frac{3}{4}$ yards of pink ribbon. How many yards of ribbon did she buy?

5. Charles worked $5\frac{3}{8}$ hours in the morning and $2\frac{5}{6}$ hours in the evening. How many hours did he work in all?

6. Tom's bat weighs $3\frac{5}{8}$ pounds and Ben's bat weighs $2\frac{3}{4}$ pounds. How much do both bats weigh?

7. How much more is $\$\frac{4}{5}$ than $\$\frac{1}{2}$?

8. How much more is $\$2\frac{1}{2}$ than $\$1\frac{3}{5}$?

9. How much more is $4\frac{1}{2}$ feet than $2\frac{3}{8}$ feet?

10. Ella has $\$1\frac{1}{4}$. How much more does she need to have $\$2\frac{1}{5}$?

11. Mary paid $\$5\frac{1}{4}$ for a dress and $\$2\frac{3}{4}$ for a hat. How much more did the dress cost than the hat?

12. The price of a football is $\$1\frac{3}{4}$, but Frank has only $\$\frac{4}{5}$. How much more does he need to buy the football?

13. It takes George $4\frac{3}{5}$ hours to walk to town and James $3\frac{1}{4}$ hours. How much longer does it take George than James?

14. It is $10\frac{1}{2}$ ft. from the floor to the top of a window, and $2\frac{5}{6}$ ft. from the floor to the bottom of the window. Find the height of the window.

15. The live weight of a beef was $1260\frac{1}{4}$ lb. and the dressed weight was $679\frac{5}{8}$ lb. Find the difference between the two weights.

Find the value of:

1. $\frac{1}{2}+\frac{1}{3}-\frac{1}{4}$

2. $3\frac{1}{2}+1\frac{2}{3}-2\frac{5}{6}$

3. $\frac{1}{3}+\frac{1}{5}-\frac{1}{6}$

4. $4\frac{3}{8}+3\frac{1}{6}-1\frac{3}{4}$

5. $\frac{3}{4}+\frac{1}{2}-\frac{4}{5}$

6. $6\frac{1}{5}+3\frac{1}{4}-4\frac{1}{2}$

Find the value of:

7. $2\frac{1}{2}-1\frac{3}{4}+\frac{7}{12}$

8. $9\frac{3}{4}-3\frac{1}{6}+2\frac{1}{8}$

9. $10-4\frac{2}{5}+2\frac{1}{2}$

10. $8\frac{2}{5}-3\frac{1}{8}+4\frac{1}{2}$

11. A boy having $\$6\frac{1}{4}$ gave $\$\frac{1}{2}$ for a knife and $\$2\frac{3}{5}$ for a hat. How much did he spend? How much had he left?

12. A man had $\$48\frac{1}{2}$. He paid $\$16\frac{2}{5}$ for a calf and $\$12\frac{3}{4}$ for a pig. How much did he spend? How much had he left?

13. A grocer bought two tubs of butter, one containing $26\frac{5}{8}$ pounds and the other $31\frac{1}{2}$ pounds. After selling $42\frac{3}{4}$ pounds, how much had he left?

14. The sum of three numbers is $41\frac{1}{6}$. One of the numbers is $18\frac{3}{5}$ and another is $13\frac{7}{12}$. Find the third number.

15. A man had $\$540\frac{1}{2}$. He spent $\$271\frac{3}{4}$ for sheep and $\$180\frac{7}{10}$ for hogs. How much did he spend? How much money did he have left?

16. From a bolt of muslin containing $32\frac{1}{2}$ yards, $17\frac{1}{4}$ yards were cut at one time, and $9\frac{3}{4}$ yards at another time. How many yards were cut off? How many yards were left in the bolt?

17. A farmer bought three cows, paying $\$35\frac{1}{2}$, $\$28\frac{3}{4}$, and $\$31\frac{2}{5}$. He sold them all for \$100. How much did he gain?

18. Two boys, A and B, are 400 feet apart. If A goes toward B $167\frac{5}{6}$ feet and B goes toward A $207\frac{3}{4}$ feet, how far apart will they then be?

MULTIPLICATION OF FRACTIONS

1. How much is $\frac{2}{5}+\frac{2}{5}+\frac{2}{5}$? How much, then, is $3 \times \frac{2}{5}$?

2. How much is $2 \times \frac{3}{7}$? $4 \times \frac{2}{9}$?

3. Find $4 \times \frac{5}{6}$.

4 × 5 sixths = 20 sixths
$= \frac{20}{6} = \frac{10}{3} = 3\frac{1}{3}$

$$4 \times \frac{5}{6} = \frac{4 \times 5}{6}$$
$$= \frac{20}{6} = \frac{10}{3} = 3\frac{1}{3}$$

To multiply a fraction by a whole number, multiply the numerator by the whole number, and under the product write the denominator.

It will shorten the work to cancel any common factor in the whole number and denominator before multiplying. This is the same as reducing the fraction to its lowest terms after multiplying.

Thus, 4 and 6 contain the factor 2; then divide 4 and 6 by 2, cancel them, and write the quotients 2 and 3 in their places.

$$4 \times \frac{5}{6} = \frac{\overset{2}{\cancel{4}} \times 5}{\underset{3}{\cancel{6}}} = 3\frac{1}{3}$$

Always use cancellation when possible.

Find the value of:

4. $3 \times \frac{5}{9}$ **5.** $6 \times \frac{5}{8}$ **6.** $12 \times \frac{5}{16}$ **7.** $10 \times \frac{4}{15}$

8. $4 \times \frac{7}{8}$ **9.** $8 \times \frac{5}{6}$ **10.** $15 \times \frac{7}{12}$ **11.** $24 \times \frac{7}{18}$

12. $9 \times \frac{5}{6}$ **13.** $6 \times \frac{7}{8}$ **14.** $16 \times \frac{3}{10}$ **15.** $125 \times \frac{2}{5}$

The word "of" following a fraction is equivalent to the sign ×.

16. Show that $\frac{5}{8}$ of $16 = 16 \times \frac{5}{8}$; $\frac{7}{12}$ of $36 = 36 \times \frac{7}{12}$.

17. How much is $\frac{2}{3}$ of 6? $\frac{2}{3}$ of 7? $\frac{2}{3}$ of 8?

18. How much is $4 \times \$\frac{1}{2}$? $3 \times \$\frac{2}{5}$? $6 \times \$\frac{3}{10}$?

How much is $8 \times 6\frac{2}{3}$?

$8 \times 6\frac{2}{3}$ means 8×6 plus $8 \times \frac{2}{3}$.
$8 \times 6 = 48$, and $8 \times \frac{2}{3} = \frac{16}{3} = 5\frac{1}{3}$.
$48 + 5\frac{1}{3} = 53\frac{1}{3}$.
Note that $8 \times 6\frac{2}{3} = 6\frac{2}{3} \times 8$.

$$\begin{array}{rl} 8 & \\ \underline{6\frac{2}{3}} & \\ 5\frac{1}{3}, & \text{Product by } \frac{2}{3} \\ \underline{48\phantom{\frac{1}{3}}}, & \text{Product by } 6 \\ 53\frac{1}{3}, & \text{Product by } 6\frac{2}{3} \end{array}$$

Find the value of:

1. $5\frac{1}{3} \times 6$ **2.** $4\frac{3}{4} \times 5$ **3.** $16\frac{3}{8} \times 12$

4. $9 \times 8\frac{5}{6}$ **5.** $8 \times 7\frac{3}{4}$ **6.** $15 \times 20\frac{1}{2}$

7. $6\frac{3}{5} \times 7$ **8.** $3\frac{5}{8} \times 6$ **9.** $4\frac{5}{6} \times 540$

10. How much will 6 bu. corn cost at $\$\frac{5}{8}$ a bushel?

11. How much will 10 pk. pears cost at $\$\frac{3}{4}$ a peck?

12. How much will $3\frac{1}{3}$ doz. oranges cost at $2\frac{1}{2}$ cents apiece?

13. How far will a boy walk in 4 hours at the rate of $2\frac{5}{6}$ miles an hour?

14. Find the cost of $12\frac{3}{8}$ cords of wood at $6 a cord.

15. A farmer sold 1255 lb. cotton at $12\frac{3}{5}$¢ a pound. How much did he receive for it?

16. A grocer bought sugar at $4\frac{3}{5}$¢ a pound and sold it at $6\frac{1}{4}$¢ a pound. Find his profits on 5 hogsheads of sugar, each weighing 1436 pounds.

17. A lady bought 6 yd. velvet at $\$1\frac{3}{4}$ a yard, and 8 yd. silk at $\$1\frac{2}{5}$ a yard. How much did she spend?

18. If a man travels on a bicycle $\frac{5}{6}$ of 48 miles a day, how far will he go in $9\frac{5}{8}$ days?

19. A grocer bought 180 eggs at $\$\frac{1}{5}$ per dozen and sold them at $\$\frac{1}{3}$ per dozen. How much did he gain?

20. Two boys start from the same point and travel in opposite directions. If one goes $2\frac{2}{3}$ mi. and the other $2\frac{3}{4}$ mi. per hour, how far apart will they be in 6 hours?

1. Multiply 20 by $3\frac{1}{2}$; by $2\frac{3}{4}$; by $\frac{4}{5}$.

2. Find the cost of 78 hats at \$$3\frac{2}{5}$ each.

3. A farmer sold $5\frac{2}{3}$ dozen apples to A, $6\frac{3}{4}$ dozen to B, and $4\frac{5}{6}$ dozen to C. How many dozen did he sell? How many apples did he sell?

4. How much more is $\frac{4}{5}$ of \$18.75 than $\frac{5}{8}$ of \$10.32?

5. If a pint of peanuts costs 5¢, how much will $1\frac{1}{2}$ pecks cost at the same price?

6. Count by 8's from 7 to 63; by $1\frac{1}{2}$'s from 3 to 15.

7. Walter paid \$$6\frac{2}{5}$ for trousers, \$$9\frac{3}{4}$ for a coat, and \$$3\frac{1}{2}$ for a vest. How much did the suit cost?

8. George and Henry bought a piece of cord 672 ft. long for their kites. If George used $\frac{3}{8}$ of it and Henry $\frac{7}{16}$ of it, how much of it was left?

9. A box contains $12\frac{2}{3}$ doz. eggs. If $5\frac{1}{2}$ doz. of them are sold, what is the value of the remainder at 30¢ a dozen?

10. Marcus lives 7 miles from town. He rode to town at the rate of 5 miles per hour and walked back at the rate of 2 miles per hour. How much longer was he in returning than in going?

11. How much less will 60 apples cost at the rate of 3 for 10¢ than at the rate of 4 for 15¢?

12. How many ounces are there in $5\frac{7}{8}$ pounds?

13. Find the cost of 6 chickens, each weighing $2\frac{3}{4}$ pounds, at 18¢ a pound.

14. When Ella started to school it was 8 : 35 A.M., and when she returned it was 1:15 P.M. How many hours was she gone?

FRACTIONAL PARTS OF A DOLLAR

$\$.50 = \$\frac{1}{2}$
$\$.33\frac{1}{3} = \$\frac{1}{3}$
$\$.66\frac{2}{3} = \$\frac{2}{3}$
$\$.25 = \$\frac{1}{4}$
$\$.75 = \$\frac{3}{4}$

$\$.20 = \$\frac{1}{5}$
$\$.40 = \$\frac{2}{5}$
$\$.60 = \$\frac{3}{5}$
$\$.80 = \$\frac{4}{5}$
$\$.16\frac{2}{3} = \$\frac{1}{6}$

$\$.12\frac{1}{2} = \$\frac{1}{8}$
$\$.37\frac{1}{2} = \$\frac{3}{8}$
$\$.62\frac{1}{2} = \$\frac{5}{8}$
$\$.08\frac{1}{3} = \$\frac{1}{12}$
$\$.06\frac{1}{4} = \$\frac{1}{16}$

Find the cost of:

1. 12 bushels of corn at $\$.75$ a bushel.

$$12 \times \$.75 = 12 \times \$\tfrac{3}{4} = 3 \times \$3 = \$9.$$

2. 8 yards of tweeds at $\$.25$ a yard.
3. 10 gallons of vinegar at $\$.50$ a gallon.
4. 16 dozen oranges at $\$.37\frac{1}{2}$ a dozen.
5. 12 bushels of apples at $\$.50$ a bushel.
6. 15 pecks of berries at $\$.20$ a peck.
7. 16 baskets of grapes at $\$.62\frac{1}{2}$ a basket.
8. 24 gallons of milk at $\$.37\frac{1}{2}$ a gallon.
9. 25 bushels of wheat at $\$.60$ a bushel.
10. 12 pounds of rice at $\$.08\frac{1}{3}$ a pound.
11. 30 bushels of potatoes at $\$.90$ a bushel.
12. 60 pounds of sugar at $\$.06\frac{1}{4}$ a pound.
13. 35 bushels of wheat at $\$.40$ a bushel.
14. 18 yards of flannel at $\$.75$ a yard.
15. 15 dozen cantaloupes at $\$.66\frac{2}{3}$ a dozen.
16. 30 pounds of honey at $\$.12\frac{1}{2}$ a pound.
17. 40 bushels of wheat at $\$.80$ a bushel.
18. 16 yards of gingham at $\$.12\frac{1}{2}$ a yard.

REVIEW

Write in words:

1. 604,240 **2.** 40,004 **3.** 9,060,015

4. 150,105 **5.** 900,700 **6.** 9,606,006

Write in figures:

7. Six hundred four thousand nineteen.

8. Five million forty thousand six hundred.

9. Four hundred fifteen thousand ninety.

10. Seven hundred thirty-one thousand nine hundred.

Add rapidly, and check:

11.	**12.**	**13.**
45,629	175,146	145,146
31,745	217,319	498,674
68,975	714,657	213,467
76,891	519,637	478,331
3,457	416,29[illegible]	747,629
12,185	197,863	513,366

Subtract rapidly, and check:

14.	**15.**	**16.**
456,021	4,567,402	45,280
94,973	1,399,206	16,792

Multiply rapidly, and check by division:

17.	**18.**	**19.**
452,007	88,607	21,000
2,369	8,006	9,807

Divide rapidly, and check by multiplication:

20. 286)475843 **21.** 406)50102030

REVIEW

1. If the sum of two numbers is 154,695, and one of the numbers is 48,967, what is the other number?

2. If the sum of two fractions is $\frac{9}{10}$, and one of the fractions is $\frac{2}{3}$, what is the other fraction?

3. If the sum of three numbers is 48,521, and two of the numbers are 4596 and 19,273, what is the third number?

4. If the sum of three fractions is $\frac{11}{12}$, and two of the fractions are $\frac{3}{8}$ and $\frac{2}{9}$, what is the third fraction?

5. The multiplicand is 20, and the multiplier is 3. What is the product?

6. The multiplicand is 15, and the product is 45. What is the multiplier?

7. The multiplier is 4, and the product is 48. What is the multiplicand?

8. The multiplicand is 8015, and the multiplier is 709. What is the product?

9. The multiplicand is 7025, and the product is 6,582,425. What is the multiplier?

10. The multiplier is 4105, and the product is 280,018,470. What is the multiplicand?

11. The dividend is 90, and the divisor is 30. What is the quotient?

12. The dividend is 4,236,600, and the divisor is 920. What is the quotient?

13. The divisor is 560, and the quotient is 7412. What is the dividend?

14. I had $40,216. After buying a house I had $29,040 left. How much did the house cost?

DECIMALS

1. Complete: 1 dollar = —— dimes, 1 dime = —— cents, 1 cent = —— mills.

2. 1 = —— tenths, 1 tenth = —— hundredths, 1 hundredth = —— thousandths.

3. 1 dime = —— of a dollar, 1 cent = —— of a dime, 1 mill = —— of a cent.

4. 1 tenth = —— of 1, 1 hundredth = — — of a tenth, 1 thousandth = —— of a hundredth.

5. If a dollar is 1, how much is a dime? a cent? a mill?

6. Write in figures 1 tenth; 1 hundredth; 1 thousandth.

Another way of writing them is .1, .01, .001.

That is, .1 is $\frac{1}{10}$, .01 is $\frac{1}{100}$, .001 is $\frac{1}{1000}$.

7. Similarly, how should .2, .03, and .007 be written?

A **decimal** is a fraction whose denominator is 10, or 100, or 1000, or 10,000, etc.

A decimal, like 13 hundredths, may be expressed by numbers in two ways, viz.: $\frac{13}{100}$ and .13. In the first form it is said to be written **fractionally** or as **a common fraction**; and in the second, **decimally** or as **a decimal**. Usually, a decimal means a decimal fraction expressed decimally.

The **decimal point** is the period written before tenths.

A decimal is read as it would be read if written fractionally.

8. Write .8, .05, .65, .009, .034, .0046, fractionally, and read them.

Ans. .8 = $\frac{8}{10}$, 8 tenths; .05 = $\frac{5}{100}$, 5 hundredths; .65 = $\frac{65}{100}$, 65 hundredths; .009 = $\frac{9}{1000}$, 9 thousandths; .034 = $\frac{34}{1000}$, 34 thousandths; etc.

In each of these answers compare the number of 0's in the denominator with the number of figures in the decimal.

A **mixed decimal** is a whole number united with a decimal.

Thus, 9.05, which means $9\frac{5}{100}$, is a mixed decimal.

In reading mixed decimals the word "and" should be used only at the decimal point. Thus, .325 is read three hundred twenty-five thousandths, while 300.025 is read three hundred *and* twenty-five thousandths.

Write fractionally, and read:

1. .3 **2.** 6.4 **3.** .018 **4.** 9.516 **5.** .00437
6. .9 **7.** .75 **8.** .201 **9.** 37.04 **10.** 51.085
11. .5 **12.** .06 **13.** 5.28 **14.** 643.5 **15.** 287.19
16. .7 **17.** 5.5 **18.** .009 **19.** .0069 **20.** .00321

Write decimally, and read:

21. $\frac{2}{10}$ **22.** $\frac{6}{100}$ **23.** $\frac{37}{1000}$ **24.** $\frac{641}{10000}$ **25.** $\frac{35}{10000}$
26. $\frac{6}{10}$ **27.** $4\frac{3}{10}$ **28.** $5\frac{6}{100}$ **29.** $9\frac{3}{1000}$ **30.** $16\frac{54}{100}$
31. $\frac{8}{10}$ **32.** $\frac{89}{100}$ **33.** $52\frac{3}{10}$ **34.** $85\frac{7}{100}$ **35.** $205\frac{1}{10}$
36. $\frac{4}{10}$ **37.** $8\frac{5}{10}$ **38.** $9\frac{12}{100}$ **39.** $\frac{45}{10000}$ **40.** $81\frac{9}{100}$
41. $3 + \frac{2}{10} + \frac{5}{1000}$

Ans. 3.205.

42. 5 ones 4 tenths 7 hundredths 9 thousandths.

Ans. 5.479.

43. $5 + \frac{1}{10} + \frac{7}{100}$ **44.** $25 + \frac{7}{10} + \frac{6}{1000}$
45. $6 + \frac{2}{100} + \frac{9}{1000}$ **46.** $48 + \frac{5}{10} + \frac{8}{100} + \frac{3}{1000}$
47. $\frac{3}{10} + \frac{5}{100} + \frac{8}{1000}$ **48.** $\frac{2}{10} + \frac{3}{1000} + \frac{4}{10000}$

49. 2 ones 3 tenths 5 hundredths.

50. 4 ones 6 tenths 2 hundredths 5 thousandths.

51. 9 ones 7 hundredths 6 thousandths.

52. 7 tenths 5 hundredths 3 ten-thousandths.

53. 2 and $\frac{3}{100}$ dollars. *Ans.* $2.03.

REDUCTION OF DECIMALS

Reduce .325 to a common fraction.

$$.325 = \frac{325}{1000} = \frac{65}{200} = \frac{13}{40}$$

Express the decimal as a common fraction, and reduce it to its lowest terms.

Reduce to common fractions (or mixed numbers):

1. .75 **2.** .625 **3.** .0625 **4.** .64
5. .736 **6.** .0125 **7.** .08 **8.** .075
9. .3125 **10.** 7.4 **11.** 6.25 **12.** 37.16
13. 3.5 **14.** 9.96 **15.** 4.036 **16.** .02

17. Reduce $\frac{3}{8}$ to a decimal.

$\frac{3}{8} = \frac{1}{8}$ of 3 ones $= \frac{1}{8}$ of 30 tenths $=$ 3 tenths, and 6 tenths over.

6 tenths $=$ 60 hundredths; $\frac{1}{8}$ of 60 hundredths $=$ 7 hundredths, and 4 hundredths over.

4 hundredths $=$ 40 thousandths, and $\frac{1}{8}$ of 40 thousandths $=$ 5 thousandths.

$$\begin{array}{r} 8\overline{)3.000} \\ \hline .375 \end{array}$$

Annex 0's *to the numerator, divide by the denominator, and point off as many decimal places in the quotient as there are* 0's *annexed.*

Reduce to decimals:

18. $\frac{1}{2}$ **19.** $\frac{7}{25}$ **20.** $\frac{19}{80}$ **21.** $\frac{1}{125}$ **22.** $\frac{3}{4}$
23. $\frac{3}{40}$ **24.** $\frac{1}{32}$ **25.** $\frac{43}{625}$ **26.** $\frac{5}{8}$ **27.** $\frac{11}{50}$

When the division does not end, as in reducing $\frac{3}{7}$, exact quotients are written like $.428\frac{4}{7}$, and approximate quotients like $.428^{+}$.

28. $\frac{5}{11}$ **29.** $\frac{51}{119}$ **30.** $25\frac{7}{8}$ **31.** $140\frac{6}{7}$ **32.** $6\frac{2}{3}$

ADDITION OF DECIMALS

Find the sum of 5.75, 16.263, 143.098, and .96.

Write the numbers so that units of the same order shall stand under one another, and add as in whole numbers, placing the decimal point under those above.

$$\begin{array}{r} 5.75 \\ 16.263 \\ 143.098 \\ .96 \\ \hline 166.071 \end{array}$$

Add:

1. 53.246, 44.82, 706.4, 49.82, .50
2. 58.07, 43.9, .84, .679, 9.3, 3.8
3. 9.74, 16.07, 924, 75.24, 31.725
4. 170, 309.6, 58.754, 3.7, 25, 3.5
5. 235 and 7 hundredths, 5 and 9 tenths, 271 and 46 thousandths, 133 and 575 ten-thousandths.
6. 27 hundredths, 83 thousandths, 984 thousandths, 7 and 8 hundredths, 74 and 125 ten-thousandths.

SUBTRACTION OF DECIMALS

From 46.3 subtract 9.375.

Write 0's above the 7 and 5 of the subtrahend, as there are no hundredths and no thousandths in the minuend; and subtract as in whole numbers.

$$\begin{array}{r} 46.300 \\ 9.375 \\ \hline 36.925 \end{array}$$

Find the value of:

1. $643.21 - 48.037$
2. $837.46 - 34.825$
3. $715.22 - 98.699$
4. $5.4361 - .87963$
5. $800.01 - 9.3721$
6. $1000.4 - 999.39$
7. $.43322 - .06845$
8. $21.547 - 8.4691$

MULTIPLICATION AND DIVISION OF DECIMALS

Multiplying and dividing decimals by 10, 100, etc.

1. Is 4 ones 3 tenths equal to 4 ones 3 tenths 0 hundredths? Is 4.3, then, equal to 4.30?

Annexing 0's to, or removing 0's from, the right of a decimal does not change the value of the decimal.

2. How many times as great as 3 hundredths is 3 tenths?

3. How many times as great as .03, then, is .3?

4. 10 × .07 = what? .7 ÷ 10 = ?

A decimal is multiplied by 10, 100, 1000, *etc., by moving the decimal point* 1, 2, 3, *etc., places to the right and annexing ciphers if necessary.*

A decimal is divided by 10, 100, 1000, *etc., by moving the decimal point* 1, 2, 3, *etc., places to the left and prefixing ciphers if necessary.*

Thus, 3.254 × 100 = 325.4; .5 × 100 = 50.
51.75 ÷ 100 = .5175; .5 ÷ 100 = .005.

Find:

1. .35 × 10
2. .046 × 100
3. 43.248 × 1000
4. .35 ÷ 10
5. 37.5 ÷ 100
6. 7483.5 ÷ 1000
7. 4.2 × 10
8. 52.8 × 100
9. 925.43 × 1000
10. 4.2 ÷ 10
11. 6.59 ÷ 100
12. 9.3765 ÷ 1000
13. .08 × 10
14. .007 × 100
15. .00042 × 1000
16. .04 ÷ 10
17. .005 ÷ 100
18. .00035 ÷ 1000
19. $3.5 × 10
20. $.47 × 100
21. $42.95 × 1000
22. $3.5 ÷ 10
23. $3.6 ÷ 100
24. $60.75 ÷ 1000

25. How much will 100 cigars cost at $.045 each?

26. If 10 pears cost $.35, how much will 1 pear cost?

Multiply 3.24 by 6.

$$\begin{array}{r} 3.24 \\ 6 \\ \hline 19.44 \end{array}$$

6 × 4 hundredths = 24 hundredths, or 2 tenths 4 hundredths. Write 4 in the hundredths' place, and carry 2 tenths.

6 times 2 tenths, plus 2 tenths carried = 14 tenths, or 1 one 4 tenths. Write 4 in the tenths' place, and carry 1 one.

6 times 3 ones, plus 1 one carried = 19 ones, which write below.

Multiply 3.24 by .6.

$$\begin{array}{r} 3.24 \\ .6 \\ \hline 1.944 \end{array}$$

$.6 = \frac{6}{10}$. Then $.6 \times 3.24 = \frac{1}{10}$ of $6 \times 3.24 = \frac{1}{10}$ of $19.44 = 1.944$.

Multiply as in whole numbers, and in the product point off as many decimal figures from the right as there are decimal places in both factors, prefixing ciphers when necessary to supply the deficiency.

1. Multiply 35.4 by 8; by .8; by .08.
2. Multiply 6.58 by 7; by .7; by .07.

Find:

3. 122 × .78
4. .1806 × 5.4
5. .0061 × .005
6. 3.25 × 16
7. 62.37 × .09
8. 305.4 × 6.36

9. Find the cost of 18.5 yd. of cloth at $.15 a yard.

10. How far will a train go in 9.75 hours, at the average rate of speed of 25.6 mi. per hour?

Show by multiplying that:

11. $\frac{3}{4}$ of 524 = .75 × 524. Tell why it is so.

12. $\frac{5}{8}$ of 768 = .625 × 768. Tell why it is so.

Divide 87.648 by 6.

Let the pupil show that the division is performed precisely as in simple numbers. See p. 179, ex. 17.

$$\begin{array}{r} 6\underline{)87.648} \\ 14.608 \end{array}$$

1. Find $\frac{1}{4}$ of 31.92; $\frac{3}{5}$ of .8375.

2. Draw a circle. Divide it into eighths. Rub out $\frac{5}{8}$. What part of a circle is left? $1 - \frac{5}{8} = ?$

3. A and B together own a lot. If A's part is $\frac{7}{12}$ of the lot, what part of the lot does B own?

4. If the seed in seed cotton is .67 of the whole, what part of the whole is the lint?

5. Find the cost of 11.125 cd. of wood at $3.20 a cord.

6. How far will a train run in 7.5 hours at the rate of 31.6 miles per hour?

7. A owns .875 of a farm. If B buys $\frac{3}{7}$ of A's share, what part of the farm will he own?

8. A man had a farm of 263.4 acres, and sold 85.75 acres of it. How many acres had he left?

9. Gordon rode 675.36 miles on the train in going from Lisbon to Troy, and 859.8 miles in going from Troy to Benton. How many miles did he ride?

10. The value of a franc (French money) is $.193, and the value of a mark (German money) is $.238. How much more is the mark worth than the franc?

11. A meter is 1.094 yards. How many yards are there in $\frac{1}{2}$ of a meter? in 10 meters? in 25 meters?

12. A pound = .3733 kilogram, and a barrel of flour weighs 196 lb. Find the weight of a barrel of flour in kilograms.

BILLS

Charles agreed to hoe the garden for his mother at 5¢ an hour. At the end of a fortnight he handed her the following bill:

Minden, La., June 15, 1910.

Mrs. F. W. Smith, Dr.

To CHARLES R. SMITH, for services rendered.

June 1	*To 6 hr. @ .$05*		*$.30*		
" 2	*" $4\frac{1}{5}$ " " "*		*.21*		
" 3	*" 8 " " "*		*.40*		
" 5	*" 5 " " "*		*.25*		
" 7	*" 4 " " "*		*.20*		
" 10	*" $7\frac{1}{5}$ " " "*		*.39*	*1*	*75*

Received payment,

....

When his mother asked him how he knew about writing a bill, he showed her this bill, sent to his uncle by the druggist:

Minden, La., June 1, 1910.

Mr. J. W. Roberts

Bought of H. B. FIELDS.

3 oz. Quinine	*$.60*	*1*	*80*		
2 oz. Paregoric	*.10*		*20*		
4 lb. Flax Seed Meal	*$.12\frac{1}{2}$*		*50*		
$\frac{1}{2}$ pt. Bay Rum	*.30*		*15*		
$2\frac{1}{2}$ doz. Calomel Tablets	*.10*		*25*	*2*	*90*

Received payment,

H. B. Fields.

In Charles's bill his mother is the **debtor** and Charles is the **creditor**. Who is the debtor and who is the creditor in the other bill?

In Charles's bill the **items** are: 6 hours' work, 4⅕ hours' work, 8 hours' work, etc. Read the items in the druggist's bill.

Charles used a sign (@) which means *at*. Copy the druggist's bill, putting in this sign. It is not necessary, but is sometimes used.

Mrs. Smith was glad to find that the footing of her son's bill was correct. Charles had made no mistake in adding. See whether the druggist's bill is footed correctly.

Charles's bill is not **receipted**. When his mother pays him, where shall he sign his name? Is the druggist's bill receipted?

Make out and receipt a bill for each of the following:

1. Sept. 16, 1910, Henry D. Strong bought of Robert Hare, Shreveport, La., ½ doz. China plates @ $2.50; 1½ doz. tumblers @ 80¢; 3 brooms @ 25¢; 4 cotton mops @ 35¢; 3 enameled pans @ 35¢; 5 flower vases @ 75¢.

2. Nov. 27, 1910, S. W. Bates bought of Morgan Hardware Co., Limited, Jackson, Miss., 12 lb. wire nails @ 4¢; 1 coil rope, 30 lb. @ 10¢; 1 length of pipe, 20 ft. @ 9¢; 15 lb. putty @ 5¢; ⅔ doz. wire clotheslines @ $1.50.

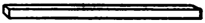
In the following, insert names, dates, and localities:

3. You buy of your teacher to-day 3 pencils for 5¢; 2 tablets @ 12½¢; 1 bottle of ink @ 5¢; ½ doz. pens @ 10¢.

4. This day your grocer sold to your father 8 packages starch @ 5¢; 1½ gal. apple vinegar @ 14¢; 2 bottles honey @ 25¢; 6 lb. Rio coffee @ 21¢; 50 lb. granulated sugar @ 6½¢; 2¾ gal. sirup @ 60¢.

VII. MEASUREMENTS

LINEAR MEASURES

Here is a picture of a splint 1 inch long: 

1. About how many inches long is your book?

2. Make an inch splint, and with it measure the length and width of this page.

3. With a foot rule, measure the length and width of your desk.

4. With a yardstick, measure the length and width of the schoolroom.

5. Name something that is usually measured by the inch; by the foot; by the yard; by the mile.

Copy and memorize:

12 inches (in.) = 1 foot (ft.).
3 feet = 1 yard (yd.).
$16\frac{1}{2}$ feet = 1 rod (rd.).
1760 yards = 1 mile (mi.).

Complete:

6. 2 ft. = — in.; $3\frac{1}{2}$ ft. = — in.; $5\frac{2}{3}$ ft. = — in.
7. 2 yd. = — ft.; $3\frac{1}{3}$ yd. = — ft.; $5\frac{2}{3}$ yd. = — ft.
8. 2 ft. 5 in. = — in.; 3 ft. 7 in. = — in.
9. 3 yd. 1 ft. = — in.; 7 yd. 2 ft. = — ft.
10. 17 in. = — ft. — in.; 29 in. = — ft. — in.
11. 11 ft. = — yd. — ft.; 16 ft. = — yd. — ft.
12. 18 in. = — ft.; 32 in. = — ft.; 9 in. = — yd.
13. How much will 7 ft. 9 in. of wire cost at 8¢ a foot?
14. How much will 5 yd. 2 ft. of cloth cost at 9¢ a yard?

How many inches are there in 25 yd. 2 ft. 7 in.?

25 yd. 2 ft. 7 in. = 931 in. *Ans*

25 yd. = 25 × 3 ft. = 75 ft.; 75 ft. + 2 ft. = 77 ft.

77 ft. = 77 × 12 in. = 924 in.; 924 in. + 7 in. = 931 in.

$$\begin{array}{r} 3\text{ ft.} \\ 25 \\ \hline 75\text{ ft.} \\ 2\text{ ft.} \\ \hline 77\text{ ft.} \end{array} \qquad \begin{array}{r} 12\text{ in.} \\ 77 \\ \hline 84 \\ 84 \\ \hline 924\text{ in.} \\ 7\text{ in.} \\ \hline 931\text{ in.} \end{array}$$

Reduce:

1. 8 ft. 10 in. to in.

2. 3 yd. 2 ft. 3 in. to in.

3. 13 yd. 2 ft. to ft.

4. 2 mi. 1 yd. 2 ft. to ft.

5. 5 mi. 35 yd. to yd.

6. 3 mi. 1 ft. 5 in. to in.

7. Reduce 319 in. to yd., ft., in.

Since 12 in. = 1 ft., there are as many feet in 319 in. as 12 in. is contained times in 319 in.; that is, 26 ft., with 7 in. over.

Since 3 ft. = 1 yd., there are as many yards in 26 ft. as 3 ft. is contained times in 26 ft.; that is, 8 yd., with 2 ft. over. Therefore, 319 in. = 8 yd. 2 ft. 7 in.

$$\begin{array}{l} 12\text{ in.}\overline{)319\text{ in.}} \\ \qquad\quad 26\text{ quo., } 7\text{ in. rem.} \\ 3\text{ ft.}\overline{)26\text{ ft.}} \\ \qquad\quad 8\text{ quo., } 2\text{ ft. rem.} \end{array}$$

Ans. 8 yd. 2 ft. 7 in.

Reduce:

8. 175 in. to yd., etc.

9. 10,375 in. to yd., etc.

10. 217 ft. to yd., etc.

11. 73,561 ft. to mi., etc.

12. 437 in. to yd., etc.

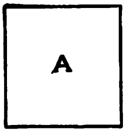
13. 20,459 yd. to mi., etc.

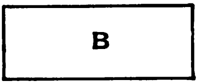
14. 375 in. to ft.

15. 2108 ft. to yd.

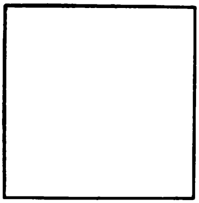
16. How much will it cost to repair a road $\frac{7}{8}$ of a mile long at $9\frac{1}{2}$¢ a yard?

SURFACE MEASURES





1. Which of these figures is a **square**? a **rectangle**?

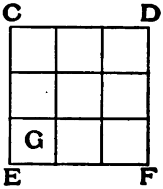


ONE SQUARE INCH

2. How many sides has each? Are all the sides of the rectangle equal? How about the sides of the square?

In a square or in a rectangle the sides that meet are said to be **perpendicular** to each other. The sides that never meet are said to be **parallel** to each other.

A **square inch** is a square whose side is 1 in.



3. What is a **square foot**? a **square yard**?

If *G* is a square foot, what is *CDFE*?

How many square feet are there in 1 square yard?

A **surface** is that which, like this page, has length and width. Surfaces are measured by squares, so surface measures are called **square measures**.

Copy and memorize:

144 square inches (sq. in.) = 1 square foot (sq. ft.).
9 square feet = 1 square yard (sq. yd.).
4840 square yards = 1 acre (A.).
640 acres = 1 square mile (sq. mi.).

Let the pupil take a foot rule and some paper, and lay off and cut out squares of different sizes.

Reduce:

1. 20 sq. yd. 7 sq. ft. to sq. ft.
2. 31 sq. ft. 5 sq. in. to sq. in.
3. 42 acres 1250 sq. yd. to sq. yd.

Complete:

4. 97 sq. ft. = — sq. yd. — sq. ft.
5. 300 sq. in. = — sq. ft. — sq. in.
6. 15,275 sq. yd. = — acres — sq. yd.
7. 387 sq. ft. = — sq. yd.
8. 12,440 sq. yd. = — A.
9. 465 sq. ft. = — sq. yd.
10. 41,140 sq. yd. = — A.

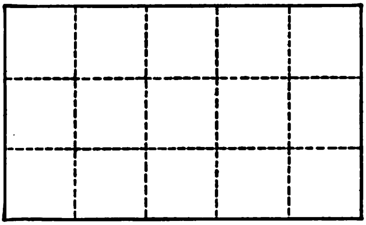
RECTANGLES

What is the surface of a rectangle which is 5 inches long and 3 inches wide?

The length and width are expressed in inches, so one square inch is the square unit (unit of surface) used as a measure.

Since the rectangle is 5 inches long, in one row there are 5 × 1 sq. in. = 5 sq. in., and since it is 3 inches wide, there are three rows.

3 × 5 sq. in. = 15 sq. in.



What is the surface of a rectangle 4 ft. long and 2 ft. wide?

The length and width are expressed in feet, so one square foot is the unit of surface used as a measure.

Since the rectangle is 4 ft. long, in one row there are 4 × 1 sq. ft. = 4 sq. ft., and since it is 2 ft. wide, there are 2 rows.

2 × 4 sq. ft. = 8 sq. ft.

What is the surface of a rectangle 7 yd. long and 4 yd. wide?

7 × 4 × 1 sq. yd. = 28 sq. yd.

What is the surface of a rectangle 2 ft. long and 3 in. wide?

The length is expressed in feet, and the width in inches. They must be changed to *like units.*

a. 2 ft. = 24 in.
24 × 3 × 1 sq. in. = 72 sq. in.

b. 3 in. = $\frac{1}{4}$ ft.
2 × $\frac{1}{4}$ × 1 sq. ft. = $\frac{1}{2}$ sq. ft.

Compare these answers.

Find the surface of each rectangle whose width and length are given below:

1. 4 in. long and 3 in. wide.
2. 6 in. by 5 in.
3. 7 ft. long and 3 ft. wide.
4. 8 ft. by 3 ft.
5. 9 yd. long and 4 yd. wide.
6. 2 yd. by 7 yd.
7. 2 ft. long and 5 in. wide.
8. 4 yd. long and 2 ft. wide.
9. 2 yd. long and 6 in. wide.
10. 5 ft. long and 9 in. wide.

These examples are usually solved thus:

5 ft. = 60 in.
60 × 1 sq. in. = 60 sq. in.

$$\begin{array}{r} 60 \text{ sq. in.} \\ \times\ 9 \phantom{\text{ sq. in.}} \\ \hline 540 \text{ sq. in.} \end{array}$$

Another name for surface is **area.**

Try to give a rule for finding the surface or area of a rectangle. Compare your rule with the following:

To find the area of a rectangle: *Multiply its unit of surface by the product of the numbers showing its length and breadth.*

NOTE. Dimensions must always be expressed in, or changed to, *like units.*

1. How many square feet are there in the surface of a floor 20 ft. long and 14 ft. wide?

2. How many acres are there in a rectangular garden 110 yd. long and 88 yd. wide?

3. I have a plot of ground 42 ft. long and 15 ft. wide. How many square yards are there in its surface?

4. How much will it cost to floor a room 21 ft. long and 15 ft. wide, at 25¢ a square yard?

5. How many acres are there in a rectangular field 660 yd. long and 148 yd. 2 ft. wide?

6. A rectangular field is 616 yd. long and 220 yd. wide. How much corn will it produce if the average yield is 25¼ bu. per acre?

7. How many square feet are in the walls and ceiling of a room which is 20 ft. long, 12 ft. wide, and 10 ft. high?

In the two sides there are 2 × (20 × 10 × 1 sq. ft.), or 400 sq. ft.
In the two ends there are 2 × (12 × 10 × 1 sq. ft.), or 240 sq. ft.
In the ceiling there are 20 × 12 × 1 sq. ft., or 240 sq. ft.
In the walls and ceilings there are 880 sq. ft.

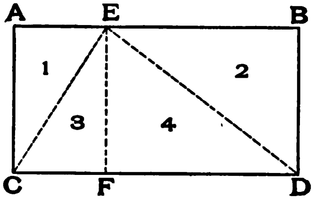
8. How many square feet are in the walls and ceiling of a room 25 ft. long, 18 ft. wide, and 12 ft. high?

9. Find the cost of plastering the same room at 30¢ a square yard, making no allowance for doors or windows.

10. A room is 18 ft. long, 15 ft. wide, and 12 ft. high. Find the cost of painting the walls and ceiling at 15¢ per square yard, deducting 60 sq. ft. for doors and windows.

11. How much would it cost to paint the walls and ceiling of a hall 30 ft. long, 9 ft. wide, and 12 ft. high, at 25¢ per square yard?

TRIANGLES



Cut a piece of paper in the form of a rectangle, like *ABDC*. Cut off the corners 1 and 2. What is left, *CDE*, is a **triangle**, of which *CD* is the **base** and *EF* is the **altitude**.

Corner 1 will fit on part 3 and corner 2 on part 4. Since two triangles the size of *CDE* can be made of the rectangle, the triangle is half of the rectangle.

The area of a triangle is its unit of surface multiplied by one half of the product of the numbers showing its length and altitude.

See Note, p. 190.

Find the number of square inches in a triangle:

1. Whose base is 12 in. and altitude 8 in.

2. Whose base is 10 in. and altitude 9 in.

3. Whose base is 15 in. and altitude 7 in.

4. Find the area of a triangle whose base is 24 ft. and altitude 18 ft.

5. Find the area of a triangle whose base is 3 ft. and altitude 11 in.

6. Find the area of a triangle whose base is 3⅙ yd. and altitude 10 yd.

7. Find the area of a triangle whose base is 9.7 yd. and altitude 5.4 yd.

8. How many square yards are there in a triangle whose base is 31 ft. and altitude 45 ft.?

9. How many acres are there in a triangular garden whose base is 96.8 yd. and altitude 60.2 yd.?

10. The base of a triangular field is 737 yd. and its altitude is 264 yd. How much is the field worth at $15 per acre?

11. How many square yards are there in a triangular lot whose base is 46.5 ft. and whose altitude is 27.6 ft.?

12. How many square feet are there in a triangular flower bed whose base is 4 yd. 6 in., and whose altitude is 4½ ft.?

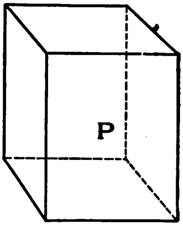
13. The bases of two triangles are 8 and 10 ft., and their heights are 6⅓ and 5½ ft., respectively. Find the difference of their areas.

SOLID MEASURES

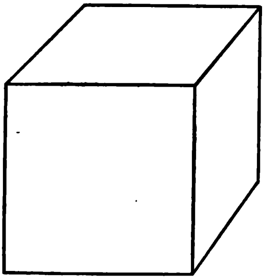
1. How long is this book? How wide is it? How thick is it?

2. *P* is a picture of a block. Point out the length of the block; the width; the height.

Things like books and blocks that have length, width, and height are called **solids**.



3. Make out of clay, or putty, or papier mâché, a solid block whose length is twice its height, but whose height and width are equal. Make a block one inch high, two inches wide, and three inches long.


ONE CUBIC INCH

4. Make a block whose height and width and length are equal. Such a solid is called a cube.

A **cube** is a solid whose length and height and width are all equal, and whose sides are all squares.

A **cubic inch** is a cube whose length, width, and height are each 1 inch.

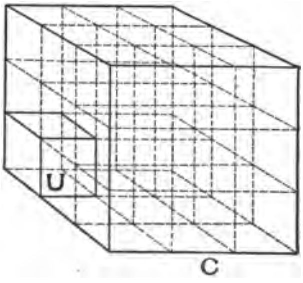
5. What is a *cubic foot?*

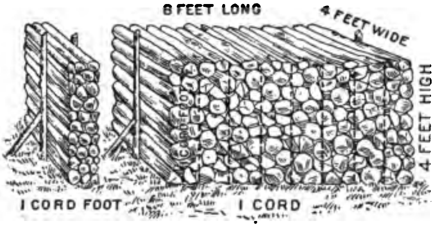
6. What is a *cubic yard?*

7. Can a cubic yard be measured by a cubic foot?

8. If *U* is a cubic foot, what is *C*?

9. How many cubic feet are there in 1 cubic yard?





A cord of wood is 8 ft. long, 4 ft. wide, and 4 ft. high.

One foot in length of a cord is called a **cord foot.**

Copy and memorize:

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.).
27 cubic feet = 1 cubic yard (cu. yd.).
128 cubic feet = 1 cord (cd.).

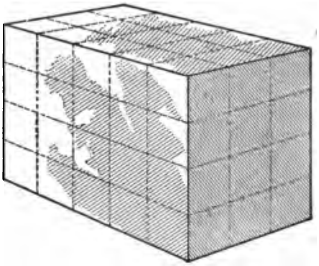
Complete:

1. 2 cu. yd. = — cu. ft.; $\frac{2}{3}$ cu. yd. = — cu. ft.
2. 5 cu. yd. = — cu. ft.; $2\frac{1}{9}$ cu. yd. = — cu. ft.
3. 81 cu. ft. = — cu. yd.; 24 cu. ft. = — cu. yd.
4. 270 cu. ft. = — cu. yd.; 6 cu. ft. = — cu. yd.

Reduce:

5. 13 cu. ft. to cubic inches.
6. 25 cu. ft. 524 cu. in. to cubic inches.
7. 9 cu. yd. 123 cu. in. to cubic inches.
8. 423 cu. ft. to cubic yards, etc.
9. 2379 cu. in. to cubic feet, etc.
10. 1274 cubic feet to cords, etc.
11. How many cubic yards are there in 1629 cu. ft.?
12. How many cubic feet are there in 9504 cu. in.?
13. How many cords are there in 21,600 cu. ft.?

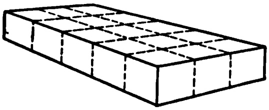
CUBOIDS



A solid, like a cube, or like the block shown in this picture, is called a **cuboid.** The corners of its sides and ends are square corners, or *right angles.* Find some cuboids in the schoolroom. Point out their right angles, or square corners.

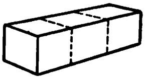
1. How many cubic inches are there in a cuboid 5 in. long, 3 in. wide, and 4 in. high?

Since the length, width, and height are all expressed in inches, the cubic inch can be used to measure the solid.



2. If the solid were cut crosswise into horizontal layers, how many layers would there be?

3. If the layers were cut crosswise into rows, how many rows would there be in each layer?



One row = 3 × 1 cu. in. One layer = 3 × 5 × 1 cu. in.
The whole solid = 3 × 5 × 4 × 1 cu. in. = 60 cu. in.

The number of cubic inches or cubic feet or cubic yards in a solid is called the **volume** of the solid.

4. What is the volume of a cuboid 6 ft. long, 4 ft. wide, and 3 ft. high?

Since the length, width, and height are expressed in feet, 1 cu. ft. is the **unit of volume.**

4 × 6 × 3 × 1 cu. ft. = 72 cu. ft.

$$\begin{array}{rl} & 4 \text{ cu. ft.} \\ \times & 6 \\ \hline & 24 \text{ cu. ft.} \\ \times & 3 \\ \hline & 72 \text{ cu. ft.} \end{array}$$ *Ans.*

Try to write a rule for finding the volume of a cuboid. Compare your rule with the following:

The volume of a cuboid is its unit of volume multiplied by the product of the numbers showing its length, width, and height.

See Note, p. 190.

The **dimensions** of a solid are its length, width, and height.

1. What is the volume of a cuboidal box 6 ft. long, 3 ft. wide, and 5 ft. high?

2. What is the volume of a room 20 ft. long, 18 ft. wide, and 12 ft. high?

3. How many cubic feet are there in a marble slab 60 in. long, 24 in. wide, and 6 in. thick?

4. How many cubic yards of coal are there in a pile 18 ft. long, 10 ft. wide, and 7 ft. high?

5. How many cubic feet of corn are there in a crib 20 ft. long and 12 ft. wide, the corn being 5½ ft. deep in the crib?

6. A pile of wood is 24 ft. long, 8 ft. wide, and 6 ft. high. How many cords are there in the pile?

7. A pile of wood is 36 ft. long, 12 ft. wide, and 10 ft. high. How many cords are there in the pile?

A cubic foot contains 1728 cu. in., and a liquid gallon contains 231 cu. in.; 1728 cu. in. contains 231 cu. in. about 7½ times. Therefore,

The space of a cubic foot will hold about 7½ gallons.

8. How many gallons of molasses will a box hold that is 4 ft. long, 2 ft. wide, and 9 in. (¾ ft.) high?

9. A box is 3 ft. long, 2 ft. wide, 8 in. (⅔ ft.) high, and is full of honey. How much honey is in the box?

How many gallons will a tank hold that is:

10. 6 ft. long, 4 ft. wide, and 10 ft. high?

11. 4 ft. long, 4 ft. wide, and 9 ft. high?

12. 5 ft. square at the bottom and 7 ft. high?

13. 3 ft. square at the bottom and 6 ft. high?

How much milk will a box hold that is:

14. 1½ ft. long, 1⅓ ft. wide, and ½ ft. high?

How much water will a box hold that is:

15. 1⅔ ft. long, 1⅕ ft. wide, and 6 in. high?

16. 9 in. long, 8 in. wide, and 4 in. deep?

A cubic foot contains 1728 cu. in., and a bushel contains 2150.4 cu. in.; 1728 cu. in. contains 2150.4 cu. in. about .8 or ⅘ times. Therefore,

The space of a cubic foot will hold about .8 *of a bushel.*

How many bushels will a bin hold that is:

17. 6 ft. long, 5 ft. wide, and 2½ ft. high?

18. 6 ft. long, 4½ ft. wide, and 2⅔ ft. deep?

19. 5⅓ ft. long, 3¾ ft. wide, and 6 ft. deep?

20. How many 2-inch cubes are there in a cuboidal block of wood 2 ft. long, 16 in. wide, and 10 in. high?

21. What will be the cost of a pile of wood 18 ft. by 6 ft. by 10 ft., at $3½ a cord?

22. How many cubic yards of earth will be removed in digging a ditch 160 yd. long, 4½ ft. wide, and 2 ft. deep?

23. How many 4-foot cubes are there in an 8-foot cube?

24. How many blocks 4 in. by 3 in. by 2 in. can be placed in a box whose inside dimensions are 3 ft. by 2 ft. 6 in. by 1 ft. 8 in.?

LIQUID MEASURES

These measures are used for measuring liquids, such as water.

Copy and memorize :

4 gills (gi.) = 1 pint (pt.).
2 pints = 1 quart (qt.).
4 quarts = 1 gallon (gal.).

Ordinarily, 31½ gal. = 1 barrel (bbl.) and 63 gal. = 1 hogshead (hhd.).

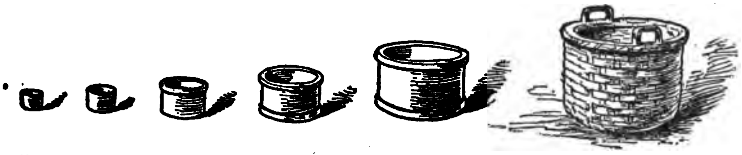
How many:

1. Gills are there in 2 pt.? in 5 pt.? 1 qt.? 3 qt.? 1 gal.?
2. Pints are there in 8 gi.? in 32 gi.? 7 qt.? ½ qt.? 3 gal.?
3. Quarts are there in 4 pt.? in 20 pt.? 2 gal.? ½ gal.?
4. Gallons are there in 1 bbl.? in 2 bbl.? 2 hhd.? 20 qt.? 56 pt.?

Reduce :

5. 12 gal. 2 qt. 1 pt. to pt.
6. 187 gi. to gal., etc.
7. 20 gal. 1 qt. 1 pt. to gi.
8. 205 pt. to gal., etc.
9. 5 hhd. 3 gal. 1 pt. to pt.
10. 925 qt. to hhd., etc.
11. 4 bbl. 6 gal. 1 pt. to gi.
12. 537 pt. to bbl., etc.
13. How many gallons are there in 324 pt.?
14. How many gallons are there in 500 gi.?
15. How much will 5 gal. 3 qt. milk cost at 24¢ a gal.?

DRY MEASURES



These measures are used in measuring dry things, such as grain, potatoes, and apples.

Copy and memorize:

2 pints (pt.) = 1 quart (qt.).
8 quarts = 1 peck (pk.).
4 pecks = 1 bushel (bu.).

One bushel contains about 2150.4 cubic inches.

How many:

1. Pints are there in 2 qt.? in 7 qt.? ½ qt.? 1 pk.? 5 pk.? ½ pk.?

2. Quarts are there in 8 pt.? in 20 pt.? 11 pt.? 2 pk.? 7 pk.? ¼ pk.?

3. Pecks are there in 16 qt.? in 36 qt.? 16 pt.? 48 pt.? 2 bu.? ½ bu.?

Reduce:

4. 2 pk. 3 qt. 1 pt. to pt.
5. 105 pt. to pk., etc.
6. 5 bu. 2 pk. 7 qt. to qt.
7. 502 qt. to bu., etc.
8. 3 bu. 5 qt. 1 pt. to pt.
9. 981 pt. to bu., etc.
10. 516 qt. to pk.
11. 752 qt. to bu.
12. 428 pt. to pk.
13. 15 bu. 2 pk. to bu.

14. How many pecks are there in 21 pk. 6 qt.?
15. How many bushels are there in 40 bu. 4 qt.?
16. How much will 5 qt. 1 pt. berries cost at 7¢ a qt.?
17. How much will 6 pk. 4 qt. peaches cost at 9¢ a pk.?
18. How much will 5 bu. 3 pk. apples cost at 60¢ a bu.?

MEASURES OF WEIGHT

These measures are used in weighing such articles as hay, cotton, and groceries. The measures are ton (T.), pound (lb.), and ounce (oz.).

Copy and memorize:

16 oz. = 1 lb. **2000 lb. = 1 T.**

How many:

1. Ounces are there in 3 lb.? in ½ lb.? ¾ lb.? 1⅝ lb.?
2. Pounds are there in 8 oz.? in 24 oz.? 50 oz.? 1½ T.?
3. Tons are there in 500 lb.? in 1600 lb.? 5000 lb.?

Reduce:

4. 5 lb. 7 oz. to oz. 5. 95 oz. to lb., etc.
6. 3 T. 64 lb. to lb. 7. 73 oz. to lb., etc.
8. 7350 lb. to T., etc. 9. 4 T. 12 oz. to oz.
10. How many pounds are there in 7 lb. 6 oz.?
11. How many pounds are there in 9 lb. 4 oz.?
12. How many tons are there in 76,320 lb.?
13. How many tons are there in 39,640 lb.?
14. How much will 12 lb. 10 oz. of shot cost, at 8¢ a lb.?
15. How much will 15¾ lb. of rice cost, at 6¢ a lb.?
16. How much will 1200 lb. of hay cost, at $8 a T.?

MEASURES OF TIME

The measures used in measuring time are year (yr.), month (mo.), week (wk.), day (da.), hour (hr.), minute (min.), and second (sec.).

Copy and memorize:

60 sec. = 1 min.
60 min. = 1 hr.
24 hr = 1 da.
7 da. = 1 wk.
365 da. = 1 yr.

The civil year is divided into twelve calendar months, thus:

January (Jan.)	1st mo.	. . 31 da.	July (July)	7th mo.	. . 31 da.
February (Feb.)	2d mo.	. . 28 da.	August (Aug.)	8th mo.	. . 31 da.
March (Mar.)	3d mo.	. . 31 da.	September (Sept.)	9th mo.	. . 30 da.
April (Apr.)	4th mo.	. . 30 da.	October (Oct.)	10th mo.	. . 31 da.
May (May)	5th mo.	. . 31 da.	November (Nov.)	11th mo.	. . 30 da.
June (June)	6th mo.	. . 30 da.	December (Dec.)	12th mo.	. . 31 da.

Usually February has 28 days, but in every leap year it has 29 days, making 366 days for that year.

Every year, except those ending with two 0's, that is exactly divisible by 4 is a leap year; as 1844, 1856, 1884.

Every year ending with two 0's that is exactly divisible by 400 is a leap year; as 1600, 2000, 2400.

Every year that is not so divisible is a common year; as 1847, 1855, 1900, and 1800.

A common year consists of 365 days, a leap year of 366 days, and a century of 100 successive years.

How many:

1. Seconds are there in 2 min.? in 5 min.? ½ min.? ¼ min.?

2. Minutes are there in 180 sec.? in 90 sec.? 3 hr.? ½ hr.? ¼ hr.?

How many:

3. Hours are there in 120 min.? in 600 min.? in 2 da.? in ½ da.? in ⅓ da.?

4. Days are there in 48 hr.? in 36 hr.? in 240 hr.? in 2 wk.? in 5 wk.?

5. Is 1824 a common or a leap year? 1838? 1874? 1855? 1900? 1700? 1600? 1950? 2200? 2800? 3000?

Reduce:

6. 32 yr. to da.

7. 583 hr. to wk., etc.

8. 32 leap yr. to da.

9. 337 min. to hr., etc.

10. 5 yr. 120 da. 15 hr. to hr.

11. 10 leap yr. 106 da. 17 hr. to hr.

12. 45,375,204 min. to yr., etc.

13. How many days are there in the century beginning with the year 1801 and ending with the year 1900?

Suggestion. 100 × 365 da. + as many days as there are leap years.

TIME BETWEEN TWO DATES

Find the time from March 12, 1896, to Sept. 23, 1909.

We place the later of the dates above the earlier, writing the numbers of the months, and subtract like units.

1909 yr.	9 mo.	23 da.
1896	3	12
13 yr.	6 mo.	11 da.

Find the time from Oct. 18, 1905, to May 10, 1910.

As we cannot subtract 18 da. from 10 da., we take 1 mo., or 30 da., from 5 mo., add it to 10 da., making 40 da., and from this take 18 da., and get 22 da.

1910 yr.	5 mo.	10 da.
1905	10	18
4 yr.	6 mo.	22 da.

As we cannot subtract 10 mo. from 4 mo., we take 1 yr.. or 12 mo., from 1910 yr., add it to 4 mo., making 16 mo., and from this we take 10 mo., and get 6 mo. (Ordinarily, we consider 30 days in a month.)

Find the time:

1. From June 7, 1903, to Nov. 20, 1905.

2. From May 12, 1901, to Aug. 20, 1905.

3. From July 8, 1890, to Jan. 25, 1904.

4. From Aug. 23, 1902, to June 4, 1918.

5. Washington was born Feb. 22, 1732, and died Dec. 14, 1799. At what age did he die?

6. Jefferson was born April 2, 1743, and died July 4, 1826. At what age did he die?

7. A note dated Sept. 25, 1905, was paid March 1, 1910. How long did it run?

8. How old to-day is a man who was born Dec. 19, 1873?

9. Jefferson Davis was born June 3, 1808, and died Dec. 6, 1888. At what age did he die?

10. Abraham Lincoln was born Feb. 12, 1809, and died April 15, 1865. At what age did he die?

11. Robert E. Lee was born Jan. 19, 1807, and died Oct. 12, 1870. At what age did he die?

12. Ulysses S. Grant was born April 27, 1822, and died July 23, 1885. At what age did he die?

13. Stonewall Jackson was born Jan. 21, 1824, and died May 10, 1863. At what age did he die?

14. Judah P. Benjamin was born Aug. 11, 1811, and died May 8, 1884. At what age did he die?

15. The noted statesman, John C. Calhoun, was born March 18, 1782, and died March 31, 1850. At what age did he die?

The Confederate Monument, Jackson, Miss., was erected in 1891. The height of the base is 16 ft., of the dado 9 ft., and of the column 36 ft. A statue of Jefferson Davis stands on the base and one of a Confederate soldier on the top.

1. Find the height of the monument described above.

2. Jefferson Davis was born June 3, 1808; he was graduated at West Point, July 1, 1828; he was elected to Congress and he took his seat, Dec. 1, 1845; he commanded the Mississippi Riflemen at the battle of Buena Vista, Feb. 23, 1847; he was elected U. S. Senator and he took his seat, Dec. 6, 1847; he was appointed Secretary of War, March 3, 1853; he was elected U. S. Senator, March 4, 1857; he resigned as Senator, Jan. 21, 1861, and was inaugurated president of the Confederacy, Feb. 18, 1861. Find his age at the time of each of these events.

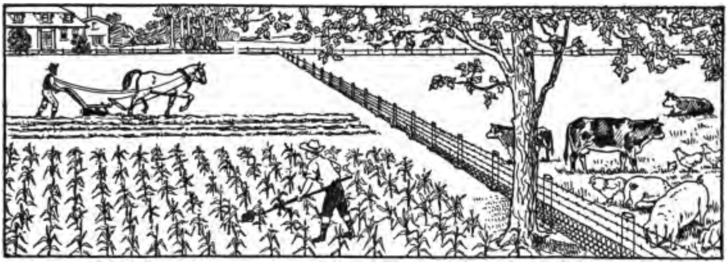
Confederate Monument, Jackson, Miss.

3. The Eiffel Tower is 984 ft. high and the Washington Monument is 555 ft. high. How much higher is the tower than the monument?

4. When Jefferson Davis was Secretary of War, the population of the United States was 23,191,876, and in 1900 it was 76,303,387. How much did the population increase during this time?

5. There were in the Civil War about 2,500,000 Federal soldiers and 750,000 Confederate soldiers. How many more Federals were there than Confederates?

VIII. FARM ARITHMETIC



1. A farmer has a field 1089 yd. long and 200 yd. wide. How many acres does it contain?

HINT. Number of square yards ÷ 4840 = number of acres.

2. How many acres are there in a field 280 rd. long and 52 rd. wide?

HINT. Number of square rods ÷ 160 = number of acres.

3. How many acres are there in a triangular garden of which one side (the base) is 32 rd. and the altitude 15 rd.?

4. The front of a plot of land is 605 yd., and its area is 16 acres. Find its depth.

HINT. Depth = area ÷ front.

5. Henry wishes to lay off in his father's field a plot of ground that will contain 1½ acres. If he makes it 110 yd. long, how wide must it be?

6. If 18 horses are grazing in a pasture 80 rd. long and 72 rd. wide, find the average acreage of pasture per horse.

7. Mr. Taylor had a pasture 124 rd. long and 85 rd. wide, which he inclosed with a 3-strand barbed wire fence. Find the cost of the wire at 3½ cents per rod for a single strand.

FARM BUILDINGS AND FENCES

In estimating lumber a **board foot** is the unit.

A board foot (bd. ft.) is 144 cubic inches. Thus, a block of wood 1 ft. long, 1 ft. wide, and 1 in. thick, which is written $1' \times 1' \times 1''$, is a board foot. So is a piece of wood $2' \times 3'' \times 2''$; that is, 2 ft. by 3 in. by 2 in.

To find the number of board feet in a piece of lumber, *multiply the length in feet, the width in inches, and the thickness in inches together, and divide the product by* 12.

Thus, the number of board feet in a piece of timber $4' \times 10'' \times 1\frac{1}{2}''$ is $(4 \times 10 \times 1\frac{1}{2}) \div 12 = 5$.

When the thickness is less than* 1 *inch, the calculation is made as if the thickness were* 1 *inch.

Find the cost of 20 joists each $16' \times 8'' \times 3''$ at $21 per M; that is, per thousand board feet.

Number of bd. ft. $= (20 \times 16 \times 8 \times 3) \div 12 = 640$; $640 \div 1000 = .64$; $\$21 \times .64 = \$13.44$.

1. Find the number of feet of lumber, and the cost of all the items in this bill at $20 per M:

36 pieces $16' \times 6'' \times 2''$
30 pieces $14' \times 4'' \times 2''$
56 pieces $18' \times 8'' \times 2\frac{1}{2}''$
42 pieces $16' \times 1' \times \frac{1}{2}''$

2. Estimate the cost of the following at $20 per thousand board feet:

4 sills $16' \times 6'' \times 6''$
9 joists $16' \times 3'' \times 8''$
16 rafters $12' \times 4'' \times 2''$
28 studs $10' \times 8'' \times 2''$

3. Estimate the cost of the following at $25 per thousand board feet:

4 plates $12' \times 4'' \times 2''$
10 beams $20' \times 3'' \times 8''$
8 sills $16' \times 4'' \times 8''$
6 posts $12' \times 6'' \times 9''$
20 joists $14' \times 3'' \times 8''$
40 planks $12' \times 2'' \times 10''$

4. If a crib 16 ft. long, 12 ft. wide, and 10 ft. deep is filled (to the top of the walls) with corn in the shuck, how many barrels of corn in the shuck, or bushels of shelled corn, does it contain?

Find the number of cubic feet in the crib and take $\frac{4}{15}$ of it.

5. A man wishes to build a board fence 600 ft. long. The posts are to be 8 ft. apart, 4 boards to the panel, and the boards 6″ × 1″. Find the cost of the boards at $18 per thousand board feet and of the posts at 15¢ each (76 posts).

6. How much will it cost to fence a field 40 rods wide and 64 rods long with a 4-strand barbed wire fence, posts 12 feet apart, if posts cost 14 cents each and wire (single strand) $3\frac{1}{2}$ cents per rod?

7. Mr. G. has a meadow 16 rods wide and 32 rods long which he wishes to fence for a hog pasture. Find (*a*) number of posts required (8 feet apart), (*b*) number of rods hog wire (woven), (*c*) number of rods barbed wire (3 strands).

8. How much will this material cost at 13 cents for posts, 60 cents per rod for hog wire, and 4 cents per rod for the barbed wire?

9. What would be the cost of paint for the outside of a one-roomed school building 40 ft. long, 20 ft. wide, and 15 ft. high at $1.75 per gallon for paint (1 gal. covering 250 sq. ft.)?

10. How much would it cost to paint the four walls of a room 25 ft. square and 10 ft. high at $1.50 per gallon for paint, and 9 cents per square yard for putting it on?

11. A concrete walk is built of bricks, cement, lime, and sand, and the materials cost about $1 per square yard. If the labor costs 20¢ per square yard, find the total cost of building a concrete walk 6 ft. wide from the schoolhouse to the road, 45 yd. distant.

POULTRY

1. A flock of 60 hens averaged 93 eggs a year each. If eggs were worth 22 cents per dozen, what was the total value of these eggs?

2. Mr. L. had 60 hens, Rhode Island Reds. They laid 6000 eggs during the year 1908. How much were these eggs worth at 19 cents per dozen? What was the average income from each hen?

3. It took 8 bushels of corn at 55 cents, 3 bushels of oats at 45 cents, and $4 worth of other feed to keep this flock for the year. What was the profit, after paying for the feed?

4. At this rate, what would be the profit on 600 hens? on 6000 hens?

5. Some hens have a record of 200 eggs per year. What would be the income from 1000 such hens at 20 cents per dozen eggs?

6. What would be the net profit on the flock if each hen cost 43 cents per year for feed?

7. At 14 cents per pound, what would be the amount received for 46 hens, each weighing 8 pounds?

8. How much would the same number of hens bring if each weighed 4½ pounds and sold at one cent less per pound on account of being in poor condition?

9. Mr. C. bought 5 barred Plymouth Rock hens at $2 each and a male at $5. During the year he sold 25 sittings of eggs at $1.50 each, 40 pullets at 75 cents each, and 8 young males at $1 each. The total cost of feed for the flock was $8. How much did he make on the flock for the year?

10. Twenty hens in 4 months hatched 210 chicks and cared for them till they were 6 weeks old. The same hens,

in the same time, with the aid of a 200-egg incubator and brooder raised 460 chicks and cared for them till they were 6 weeks old. If the chickens in both cases were sold at 10 cents each above the cost of raising, how much was gained by using the incubator?

11. If this could be done for each four months, what would be the net profit on the 20 hens, estimating cost of feeding them at $13 for the year?

12. At the same rate, what would be the profit on 100 hens?

CORN

There is no Southern crop in which improved methods of cultivation, proper fertilizing, and seed selection will bring greater rewards than in that of **corn.**

On level land corn is often planted in checks three or four feet each way. On rolling or hilly land it is usually planted in rows three to five feet apart, the "hills" being from one to three feet apart. The average yield per acre in the United States ranges from 11 to 38 bushels shelled corn. In the South it usually requires a barrel (3 bushels) of corn in the shuck to make one bushel of shelled corn. The total amount of corn produced in the United States in 1907 was 2,592,320,000 bushels. The estimated crop for 1909 was 2,668,650,000 bushels. The average yield per acre for the entire country is about 25 bushels.

CORN CLUBS

In many counties (or parishes) there are **corn clubs** composed of boys under twenty-one years of age who obligate themselves to cultivate small tracts of one or more acres of corn according to modern scientific methods.

There are prizes offered, usually by the business men of the county, for the largest yield per acre, and each boy entering the contest is required to make a detailed report on the nature of his soil, methods of preparation and cultivation, kind of seed planted and of fertilizer used, cost of cultivation, cost of fertilizer, and amount of labor required to grow the crop. When the corn is ready for gathering, each field is visited by competent judges, and the yield is carefully estimated by selecting an average spot and finding how many bushels (barrels, in the shuck) have been produced on a given area, say, one or two square rods. From this it is easy to find the average yield per acre of the entire patch, whether it be one acre or several acres.

These clubs are usually organized under the direction of the school superintendent of the county.

1. In one county in Mississippi in 1909 the average yield of corn was 14 bu. per acre. In the same county the average yield for the Corn Club boys was 70 bu., with a maximum of 152 bu. per acre. What is the value of the yield from a farmer's 40 A., under ordinary methods, at 70 cents per bushel?

2. Find the value of the crop from the same field under modern methods, with a yield of 70 bu. per acre.

3. Estimating the cost of cultivation and gathering at $3.50 per acre, by the usual method, and double this for scientific methods, find how much the farmer would have gained on 40 A. by using modern methods.

4. If the 1909 crop in the United States was raised on 97,000,000 A. of land, what would have been the total yield at 70 bu. per acre?

5. Mississippi produces about 43,000,000 bu. of corn a year at the rate of 17 bu. per acre. How much would the same state produce at the rate of 70 bu. per acre?

6. What would be the value of this at 75 cents per bushel?

7. One man in North Carolina produced 226 bu. of corn on an acre of land in 1909. How much would he have produced on 100 A. at this rate?

8. The same acre on which 226 bu. of corn were raised in 1909 yielded only 5 bu. of corn in 1901. How many such

acres would have been required to produce in 1901 as much corn as this acre produced in 1909? (The increased production was due entirely to improved methods of preparation and cultivation of the soil and to seed selection and fertilizers.)

9. In Pleasant Valley School the boys cultivated a prize acre of corn and gathered 93 bu., for which they won a prize of $15. They sold the corn at 70 cents per bushel. How much did they have left for a school library, after spending $20 for baseball suits and equipment?

10. Frank used selected seed corn, and his yield was 8 bu. of corn per acre more than his brother's. His total income exceeded his brother's by $38.40. If he sold his corn at 60 cents per bushel, how many acres did he plant?

11. Henry worked one acre of corn on Saturdays and after school each day. He spent $9 for fertilizer, $2 for hauling, $5 for rent, and $.80 for extra labor. How much did he make on his crop if he sold 62 bu. from the acre at $.60 per bushel?

12. What would have been his gain if he had raised 98 bu.?

13. At $.60 per bushel how much would his father have received from his 43 A. at a yield of 98 bu. per acre?

14. How much would this corn bring at 68 cents per bushel?

15. James Brown had 1½ A. of land in corn, and it was found that a plot of this 22 yd. one way and 10 yd. the other produced 2 bu. How much did his entire patch yield? How much was this per acre?

16. Robert and John Mayfield rented 2 A. of land from their father and planted it in corn. They gathered

136 bu., which they sold for seed at $1.50 per bushel. The entire expense to them, including seed, rent of land and teams, and cost of fertilizer, was $32. How much did they receive for their labor?

17. Tom planted 4 A. in corn, using his father's land and team. He raised 200 bu., which he sold at $.60 per bushel. On his best acre he raised 80 bu., winning the Corn Club prize of $25. If he paid $40 for fertilizer, what was his net income from the crop?

18. Tom's father planted 35 A. and raised 700 bu. If he had used Tom's methods and the same amount of fertilizer per acre, how much would he have gained, if his average production had been the same as Tom's?

COTTON

Cotton is strictly a Southern crop. The annual production in the South is 10 to 13 million bales of lint, 500 lb. each.

For each bale of lint (500 lb.) there are about 1000 lb. seed, or 1500 lb. seed cotton all together. The price of cotton (lint) ranges from 8 cents to 15 cents per lb. Seed sells at $15 to $30 per ton. The average production per acre in the entire South ranges from 160 lb. to 220 lb. lint and twice this number of pounds seed; but by improved methods of cultivation, seed selection, and fertilizing it is possible to raise two or more bales per acre. The chief enemy to the cotton plant is the Mexican boll weevil (see p. 219), but the ravages of this insect can be checked by intelligent methods of farming.

1. In 1907 Mississippi produced 1,468,177 bales of cotton. How much did this cotton bring at the average price of 11 cents per pound, allowing 500 lb. to the bale?

2. How much were the seeds worth at $16 per ton?

3. How much would the same seed have brought at $27 per ton?

4. How much did it cost to have this cotton picked at 65 cents per 100 lb. of seed cotton?

5. This cotton was raised on 3,220,000 A. of land. How many pounds of seed cotton did this average per acre?

6. The same quantity of cotton could easily be raised on one half this acreage. If this had been done and if the remaining 1,610,000 A. had been planted in corn with an average production of 40 bu. per acre, what would have been the gross increase in wealth to the state for the year? (Consider corn worth 70 cents per bushel.)

7. On account of the boll-weevil invasion, Mr. S. reduced his cotton acreage from 20 A. to 10 A. By use of scientific methods, under government direction, he raised 9 bales on his 10 A. as against 8 bales on 20 A. before the weevil appeared. On the remaining 10 A. he produced two crops (oats and peas), which brought him a net return of $20 per acre. He sold his cotton at 13 cents a pound, and his seed at $25 per ton. How much did he receive from the 20 A.?

RECKONING FARM CROPS

A crib 15 ft. × 12 ft. × 10 ft. is full of corn in the shuck. How much shelled corn would this make?

$15 \times 12 \times 10 = 1800$, the number cubic feet in the crib.

$1800 \div 3 = 600$, the number of cubic feet of shelled corn.

$600 \times .8 = 480$, the number of bushels of shelled corn.

Rule. *Multiply the length in feet, the width in feet, and the height in feet together, and multiply* $\frac{1}{3}$ *of the product by* .8.

Note. This rule is only approximately correct, but is sufficiently accurate for ordinary purposes.

1. A crib 16 ft. × 18 ft. × 10 ft. is full of corn in the shuck. How many bushels of shelled corn would this make?

2. A pole pen 16 ft. square and 11 ft. high is full of corn in the shuck. How much shelled corn would this make?

3. How many bushels of shelled corn are there in a conical pile of corn in the shuck, if the circumference of the base is 20 ft. and the height 6 ft.?

20 × 20 × 6 = 2400; 2400 ÷ 141 = 17+. That is, about 17 bu.

RULE. *Multiply the circumference of the base by itself, multiply this product by the height of the pile, and divide by* 141.

4. A conical pile of corn in the shuck is 9 ft. high, with circumference of base 30 ft. How much shelled corn would it make?

5. A quantity of corn in the shuck is thrown into a corner of a crib, thus forming one fourth of a conical pile. If the height is 6 ft. and length around the base (¼ of a circumference) 12 ft., how much shelled corn would the pile make?

6. How many bushels of oats will a bin hold that is 6 ft. by 4 ft. by 5 ft.? (See p. 197.)

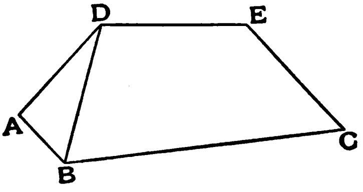
7. How many gallons of honey will a tin box hold that is 2 ft. long, 1 ft. 8 in. wide, and 9 in. deep? (See p. 196.)

8. How many bushels of potatoes will a wagon hold that is 10 ft. long, 3 ft. wide, and 2½ ft. deep?

10 × 3 × 2½ = 75, number cubic feet in the body of the wagon.
¾ of 75 = 56¼, number of bushels.

Potatoes, apples, etc., are always sold by heaped measure; so that ¾ of the number of cubic feet is about the number of bushels.

9. A farmer has a box 4 ft. by 3 ft. by 2⅓ ft., full of apples. How much are the apples worth at 60 ¢ a bushel?



Sweet potatoes are sometimes stacked in oblong piles tapering to a *ridge* (*DE*) at the top.

To find the number of bushels in such a pile, express all the dimensions in feet, then:

Add twice the length of the base to the length of the ridge, multiply the sum by the width of the base, multiply this product by the height, and divide by 8.

How many bushels of potatoes are there in an oblong pile, the base being 20 ft. by 8 ft., the height 5 ft., and the ridge 13 ft.?

$2 \times 20 + 13 = 53$; $53 \times 8 = 424$; $424 \times 5 = 2120$; $2120 \div 8 = 265$. *Ans.*

To find the number of bushels of potatoes in a round *bank*, like a cone, express all dimensions in feet, then:

Multiply the circumference of the base by itself, multiply this product by twice the height, and divide by 101.

10. A farmer has six round banks of sweet potatoes, each 18 ft. around and tapering to a point in the middle 4 ft. above the ground. How many bushels has he?

11. Mr. L. had 7 A. of sweet potatoes from which he gathered an average of 207 bu. per acre. How much were these worth at 70 cents per bushel?

12. How many banks like those in example 10 were required to put away these potatoes for the winter?

13. An ordinary box car is 8 ft. wide by 32 ft. long. If filled 4 ft. deep, how many bushels of Irish potatoes would this car hold? What would be the weight of the car load (60 lb. per bushel)?

14. In 1907 there were 6000 A. planted in Irish potatoes in Mississippi and the yield was 540,000 bu. What was the average per acre? How much did Mr. B receive for his crop of 15 A. at 93 cents per bushel?

15. In the same year Mississippi produced 1,611,000 bu. of oats on 90,000 A., while the state of Washington produced 10,545,000 bu. on 190,000 A. What was the average production per acre in each state and what was the value of the two crops at 65 cents in Mississippi and 45 cents in Washington?

16. How many cars were required to haul the Washington crop at 48,000 lb. to the car? (A bushel of oats weighs 32 lb.)

FARM DRAINAGE

Many of the most fertile acres of farm land are unproductive for lack of **drainage.** Tile draining is often used to resuscitate such lands, and is becoming more popular as the farmers learn how profitable it is.

1. If tiles cost $20 a thousand (each tile being 1 ft. long) and it costs $.50 a rod to have them laid, how much will it cost to run four lines of tiling across a field 80 rd. wide?

2. If this field is square, how much will this be per acre?

3. If Mr. Jones tile-drains 20 A. of his low land at a cost of $6 per acre and finds that this increases the yield of corn by 5 bu. per acre for each year, in how many years will the increased yield have paid the cost of drainage, if corn sells at $.60 per bushel?

4. What will be the net profit per acre to Mr. Jones in 10 years, on above basis?

5. The very lowest and wettest land can be drained by lines of tiling 3 rd. apart (if proper fall and outlet can be had). How many 1-ft. tiles would be required for a field 60 rd. × 120 rd., if the lines of tiling extend crosswise and are laid 1½ rd. from each side of the field?

6. How much would this cost per acre if tiling costs 2 cents per foot and the laying costs 30 cents a rod?

7. If this tract of land will produce $\frac{1}{4}$ of a bale of cotton more to the acre than it did before being tiled, how many years will it require to pay the cost of drainage by the increase in production, estimating cotton at $60 per bale?

8. If the increased production on account of drainage averaged $10 per year for each acre, what would be the value of the total increase on this tract in 30 years?

9. What would be the net gain for this time?

10. Measure your school yard (the longest way) and estimate the cost of putting in a line of tiling at $25 per 1000 ft. for tiling and 25 cents per rod for laying it.

HOGS

The raising of hogs for packing purposes has been largely confined to the grain regions of the middle west, but recent experiments have demonstrated the fact that the conditions in the South are almost ideal for hog raising. The importance of the breed selected is illustrated by the following figures from an experiment in Alabama.

Two herds, Berkshire and scrubs, were raised under exactly the same conditions. The Berkshire pigs averaged 146 lb. at 5 mo. and 285 lb. at 10 mo. The common pigs, or scrubs, averaged 76 lb. at 5 mo. and 214 lb. at 10 mo.

1. At 8 cents per pound, how much would 20 of the Berkshire pigs bring at 5 months? How much would 20 of the common pigs bring?

2. At 8 cents per pound, how much more would 20 of the Berkshires at 10 months bring than 20 of the common pigs, or scrubs?

3. Assuming that the cost of raising these pigs averaged 50 cents per month (a high estimate), what would be the profit on a herd of 100 scrub pigs 10 months old at 8 cents per pound?

4. What would be the profit on the same number of Berkshires?

5. It is found that 1 bu. of corn will make an average increase of about 10 lb. in weight of a hog (of good breed). If hogs sell for 7½ cents per pound, how much would the corn be worth per bushel?

6. If corn were worth 85 cents per bushel, what would be the lowest price for which the hogs could be sold without loss?

7. If hogs could be raised on pasture at 4 cents for each pound of increase in weight and then "fattened" on corn at 60 cents per bushel to add the last 100 lb., what would be the profit on each 300-lb. hog if sold at 8 cents live weight?

8. There were 12 Berkshire pigs in one litter. One sixth of them died, but the remaining pigs were sold at $5 each when 5 weeks old. How much did they bring?

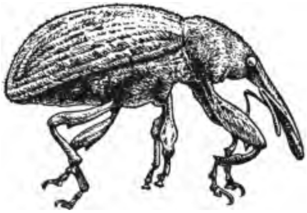
9. How much profit would there be in a year from 10 sows if each raised 20 such pigs to selling age, and the cost of keeping them was $100?

10. Mr. A. lost $\frac{3}{7}$ of his hogs by disease due to impure water and spoiled feed. He sold the remainder for $1200. What was his total financial loss on the hogs that died?

11. Mr. Smith sold his hogs, on foot, for 9 cents a pound and received $2250 for the lot. Had he waited 10 days, he could have sold them at 10 cents a pound. How much would he have gained by waiting?

12. If he had sold them at 12 cents, dressed, he would have received $2400 for the lot. What would have been the loss of weight in dressing?

INSECTS



Side View of Adult Boll Weevil. (Magnified)

Most **insects**, in the course of their development, pass through four stages, known as (1) the **egg stage**, (2) the **larval stage**, (3) the **pupal stage**, and (4) the **adult stage**.

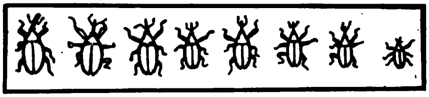
1. The egg is laid by the adult insect.
2. The egg hatches into a larva (sometimes popularly called the "worm," "maggot," or "grub"). It is in the larval stage that insects make most of their growth. During this stage they feed greedily.
3. When the larva reaches its maturity, as a larva, it enters the pupal stage. In this stage it takes no food, but remains motionless. The insect in this stage is known as a "pupa" or "chrysalis." The cocoon of a moth illustrates this stage.
4. From the pupal stage the insects become adult or mature. Most insects are very active in the adult stage and feed freely. All growth, however, is made in the larval and pupal stages.

Some insects are beneficial and some are injurious. Among the beneficial insects are the honeybee, the ladybug, and, in certain ways, the mud-dauber; and among the injurious insects are the boll weevil, the ant, and the cattle tick.

Note. Strictly speaking, a cattle tick is not an insect. Insects have 3 legs on each side, and creatures which have 4 legs on each side, like cattle ticks and spiders, are **arachnidæ** (ȧ-răk′ni-dȧ).

The Boll Weevil.

The **boll weevil**, in its development, passes through the four stages mentioned above.



NATURAL SIZES OF ADULT BOLL WEEVILS

The adult female boll weevil deposits from 100 to 150 eggs (average about 125), each one being placed in a separate square or boll.

In about 4 days after being laid, the egg hatches into the larva or "worm," which feeds inside the square and destroys it.

An average time of 12 days is required for the larva to attain its growth; then it changes into a pupa.

The pupal stage lasts about 7 days. The pupa then changes into the adult boll weevil.

1. If a mother boll weevil lays 10 eggs per day, placing each in a separate square, which is destroyed by the larva, and if the mother destroys 8 other squares a day by feeding in them, how many squares will be destroyed in two weeks?

2. If a mother boll weevil lays 130 eggs, beginning on July 1 and finishing on July 12, and if 4 days are required for the hatching of the egg, 12 days for growth of the larva, and 7 days for passing through the pupal stage, when will the first of the eggs laid reach maturity?

3. When will the last ones reach maturity?

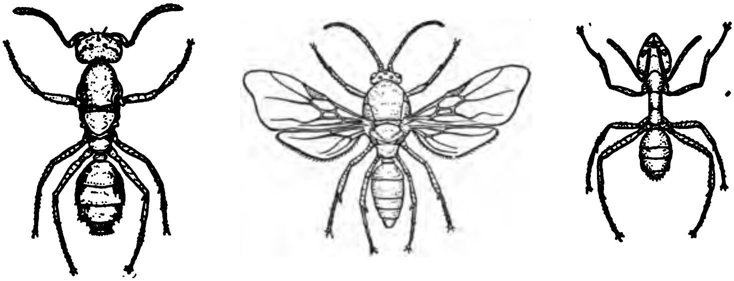
4. If $\frac{9}{10}$ of the eggs hatch, how many weevils will there be?

5. If the boll weevils destroy $\frac{1}{3}$ of the cotton crop on land that produces an average of 1 bale (of 500 lb.) per acre, what will be the loss per acre to the farmer when cotton sells at 10 cents per pound?

6. What will be the loss when cotton is worth 15 cents?

7. What would be the loss on 240 A. of cotton when cotton sells at $12\frac{1}{2}$ cents per pound?

The Argentine Ant.



DRONE QUEEN WORKER

ARGENTINE ANTS. (Magnified)

This is a small, brown ant which is very abundant and a great nuisance in some parts of the South.

Ants are "social insects," something like bees. By this is meant that they live in colonies, certain individuals, the queens, laying the eggs, others, the workers, doing the work of the colonies, and still others, the males or "drones," doing no work at all.

Thus, three kinds of ants are found in every colony. Each one of these three kinds passes through the four regular stages of development, — egg, larva, pupa, and adult.

The queen is the only individual that lays eggs. There may be a large number of queens in a single colony. In warm weather a queen lays an average of 30 eggs a day. A queen may live for several years.

The workers have no wings. They do not lay eggs. It is their duty to "nurse" the eggs, to procure the food and feed the larvæ, and to defend the colony against its enemies.

The males are not protected by the workers and die soon after reaching maturity.

The eggs (that is, those which are going to produce workers, the most numerous individuals of the colony) hatch in an average time of 32 days into small white larvæ, and in about 31 days the larvæ complete their growth and become pupæ (plural of "pupa").

The pupæ do not receive any food, and after remaining motionless in the nest for about 15 days they change into mature worker ants.

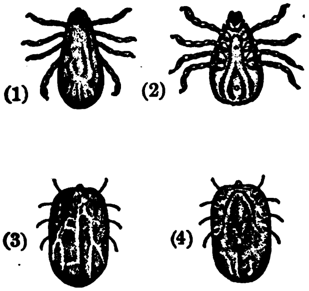
1. If the queen ant lays 30 eggs per day for two weeks and if the eggs hatch in 32 days, the larvæ attain their growth in 31 days, and the pupæ develop in 15 days, how many days will elapse until the first young ants reach maturity?

2. How many days will pass before the last ones reach maturity?

3. How many young ants will there be?

4. How many young ants will there be if the queen lays 40 eggs per day, instead of 30, and if $\frac{1}{20}$ of the eggs fail to hatch, and $\frac{1}{7}$ of the larvæ die before they reach maturity?

The Cattle Tick.



Male and Female Cattle Ticks. (Natural Size)

(1) Dorsal view of full-grown male.
(2) Ventral view of full-grown male.
(3) Dorsal view of adult female (engorged).
(4) Ventral view of adult female (engorged).

The **cattle tick** is common throughout the South and does much damage by sucking the blood from cattle, and also by giving them a disease known as "Texas fever."

All stages, except the egg, in the development of the tick are passed on the cow (or steer, calf, etc.). The ticks fasten themselves to the skin of the animal by means of their beaks and legs.

When the female tick reaches maturity, her body is engorged with blood sucked from the cow. The female tick drops to the ground, crawls into a bunch of grass, and there lays about 2000 minute eggs.

In about 22 days these eggs hatch into "seed ticks," or baby ticks. The baby ticks crawl up on stems of grass, and get on cattle which brush against it. As soon as they get on the cow, they insert their beaks through the skin and commence to suck blood, upon which they feed. They then begin to grow. As they get larger their skins become too small, and these are shed 3 times during the process of growth.

In about 21 days after the seed ticks get on the cow, they become full-grown ticks. The female ticks then drop off to the ground and lay eggs. Thus another generation begins.

The seed ticks at first have six legs, but after they have shed their skins the first time they have 8 legs. Their development is a continuous growth, not a transformation from one stage to another. (A tick is *not* an *insect.*)

1. If one mother tick lays 1266 eggs, another 1473 eggs, another 1529 eggs, and three others 3244 eggs each, how many eggs are laid by the 6 ticks?

2. If $\frac{28}{100}$ of the eggs fail to hatch, how many seed ticks will there be?

3. If ticks reduce the weight of a steer 75 lb. during a season, what would be the corresponding loss in weight in a herd of 149 beef cattle?

4. What would be the amount of this loss, in dollars, when beef cattle sell at $6 per hundred, live weight?

5. Some cattle were sold for $1200 at 5 cents per pound, and had they not been infested with ticks, would have brought 8 cents per pound. Find the loss caused by the ticks.

BIRDS

It is useful to know the habits of birds so that only those which are harmful may be indiscriminately killed.

Some birds are able to take care of themselves almost as soon as they are hatched.

When they leave the shell they are covered with down, and feathers soon grow. They stay in the nest only a short time after they are hatched. To this class belong the quail, partridge, pheasant, duck, goose, snipe, plover, and chicken. These birds are useful, because they destroy hurtful insects and are good to eat.

Some birds are helpless for some time after they are hatched.

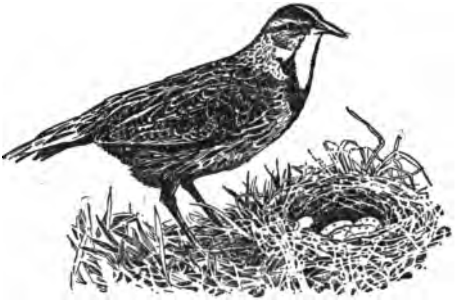
When they leave the shell they are nearly naked; their eyes are closed; their wings and legs are weak; and they have to be brooded and cared for until they are able to care for themselves. All these birds build nests, which are often very cleverly woven. Of this class are the mocking birds, the wrens, — in fact, all the song birds; also the crows, jays, hawks, and owls. Only a few of this kind are good to eat. Most of them are very useful because they eat insects that destroy the crops; others are useful because they destroy rats, mice, and weasels.

Nonpareil, or Painted Bunting

Nonpareil, or Painted Bunting.

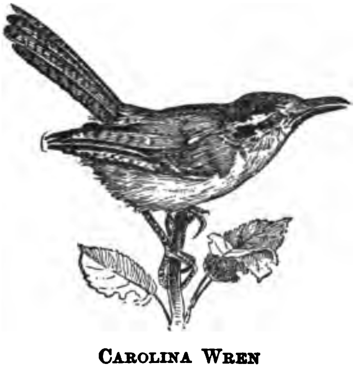
This brilliant little bird, with its bright red breast and blue cap, is not often seen close to the house, but is quite common in the thickets just outside of the yard. Like the wren, it does not like to show itself, and will stay hidden; but we can tell when it is near by its cheery, canary-like song coming from the midst of a near-by thicket. It feeds on wild seeds most of the time; but in the spring, when it is feeding its young, it eats many insects, — feeding its young altogether on insects till after they have left the nest.

Meadow Lark.



Meadow Lark

This bird is one of the farmer's best friends. It is not a true lark, but is a cousin of the blackbird. Often as it flies up from the grass with a whirr, it is mistaken for a young quail; but we cannot be misled if we look for the bright yellow throat and breast, and for the black necktie. It feeds mostly on insects and weed seed, occasionally eating a little of our domestic grains; but it amply repays for all of these by the amount of insects and weeds it destroys.



Carolina Wren

Carolina Wren.

This modest little bird is often seen in the bushes near the house; but it seldom sits still long enough for one to get a good look at it. If we try to follow it up, it will not fly far, but, sitting on the bough just out of reach, will scold away in its own little language, as much as to say, "Don't bother me, I'm too busy to play." It is hunting from sunrise to sunset among the foliage for worms and all kinds of insects which make up its food; and thus helps the farmer in its own way. The wren is about 4 inches long, very active and sprightly, and has a pleasing song.

Yellow-billed Cuckoo.

Many of us have heard the cuckoo, but fewer of us have seen it. It is very shy and retiring in nature, and generally all that can be seen of it in the woods is a glimpse of a brown bird darting quickly and silently away. Cuckoos are great worm eaters, hunting in the cool of the morning and afternoon for all kinds of worms that eat up the leaves of trees and shrubs. A single cuckoo has been known to eat as many as 500 army worms in a day.

YELLOW-BILLED CUCKOO

Night Hawk, or Bull Bat.

This is not a true hawk or bat, but is closely related to the chimney swift. At about sunset in the spring and summer, one can see the night hawk flying lightly over the fields, darting back and forth. At times, it soars high in the air, then suddenly turns and dashes headforemost to the earth, only to turn again and rise just before the ground is reached, with a rushing, booming sound. Its flight is somewhat like that of the leather-winged bat, for which it may be mistaken, although it is larger. The zigzag flying is due to the chasing of insects by the hawk. It spends the night in catching those insects which we do not see during the daytime.

NIGHT HAWK, OR BULL BAT

These birds save so much damage to crops, by their destruction of insects, that they should never be indiscriminately shot.

Orchard Oriole.

Swinging in a nest in the fig or the orange tree we may find four or five brown orioles that open their yellow mouths the minute we touch the nest. These are the young of the orchard oriole, and, if we watch for a while, we may see the mother and father birds come back with worms or butterflies or moths, to feed their hungry babies These birds spend all of their time in and about the orchard looking for insects, which are doing damage to the fruit.

ORCHARD ORIOLE

Sparrow Hawk.

This is the smallest of our hawks and is often seen flying over the meadows or even over house lots. But we need not fear for our chickens or young turkeys, for, although it is a true hawk, it very seldom takes the liberty to carry off any kind of poultry. As it flies close to the ground, it is ever on the lookout for grasshoppers; or as it sits on the fence post, it watches for a mouse to make its appearance. Nearly one fourth of the food of this hawk consists of mice, and over seven tenths of its food consists of grasshoppers and other insects.

SPARROW HAWK

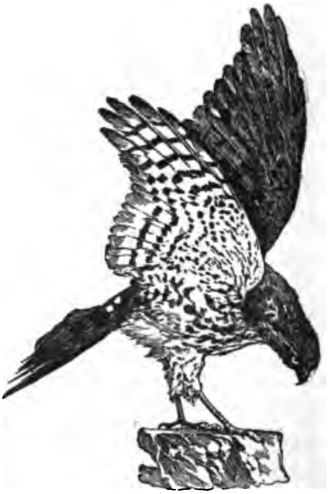
Barn Owl.

Sometimes a farmer misses a chicken at night and can find no traces of it, but later finds a few of the feathers way off in the woods. Probably the barn owl has played the thief; but let us not think that because he has taken one chicken the owl is to be hunted and killed. On the contrary, it should be encouraged to stay around. For every chicken that the owl may take, it kills many rats and mice; and these, if they were not killed, would do far more damage than the value of the chicken. It is estimated that a rat will do damage to the extent of 50 or 60 cents a year, and that a weasel may do as much as $5 worth of damage. Each one of these owls kills hundreds of mice, rats, and weasels every year, so that it fully repays for any chickens or poultry that it may take.

Barn Owl

Sharp-shinned Hawk.

This and its cousin, the Cooper's hawk, rightly deserve to be called "chicken" or "hen" hawks. We must not confuse them with the sparrow hawks. They are a little larger and of a grayish color, streaked and blotched with white. They are very brave and daring and extremely active on the wing. We should learn to know them and be able to distinguish them anywhere so that they may be killed. If they cannot find any chickens or young quail to feast on, they will catch any small bird that may happen to come across their path. Not more than one twentieth of their food consists of mice and rats, while three fourths of it consists of poultry, game, and other birds. These are among the few birds that really do far more harm than good, and so must be considered as among the farmer's enemies.



Sharp-shinned Hawk

Screech Owl.

What has been said of the barn owl may be said of the screech owl, for they are cousins, and have the same habits. This owl is, however, smaller, and so does not kill so many rats or weasels; but to make up, it probably destroys many more mice. It will not take a full-grown fowl, but will occasionally help itself to a small chicken.

SCREECH OWL

1. If two parent wrens eat 50 worms in a day apiece and feed their five young 30 worms a day apiece, how many worms will it take to feed that wren family?

2. If a field mouse causes a farmer a loss of 2 cents a year, how many dollars' worth of damage will 1500 mice do?

3. If each hawk or owl kills 1100 mice a year and each mouse causes a loss of 1¾ cents a year to the farm, how many dollars will each hawk or owl save the farm?

4. If a marsh hawk saves the farmer $ 20 a year by killing rats and mice, and he steals 3 chickens during that time, worth 25 cents each, what is the actual value of the hawk?

5. A sharp-shinned hawk kills in a year 500 mice, which cause a damage of 2 cents each; and also 300 quail and partridge chickens valued at 15 cents each. Is the hawk beneficial or detrimental, and by how much?

6. It is estimated that insects damage farm crops to the amount of about 50 cents per acre each year. How much would this amount to for your county?

7. If wild birds average 1800 to the square mile, how many would this be for your county or parish?

8. If each bird eats, on the average, 50 insects a day, how many insects would the birds of your county destroy in the summer months?

9. Supposing that 100,000 insects would equal 1 bu. of insects, how many bushels of insects would these birds destroy in your county in one month?

10. The winter birds eat chiefly grass and weed seeds. If they average 2 birds to the acre, and each eats $\frac{1}{4}$ oz. of seed per day, how many pounds of seed would the birds eat in 150 days from one square mile of your county?

11. If 500 grasshoppers will eat one pound of grass or other crops in a day, how many meadow larks will it require to save a ton of crop in 10 days, if each bird destroys 250 grasshoppers in a day?

12. Quail are especially useful in destroying harmful insects. It is estimated that a pair of these birds is worth $5 per annum on a farm. If this pair succeeds in raising a brood of 18 young quail, what will be the value of the covey next year?

DAIRYING

Dairying can be made very profitable.

There is no profit in keeping a cow that gives less than 300 lb. of butter a year. Such animals should be sold for beef.

A good separator is a necessity if as many as four cows are kept. Stables for cows should be dry, warm in winter, and well ventilated. Special provision should be made for saving every particle of fertilizer for use on the farm. Feed schedules should be studied carefully with a view to forcing the cow to give the largest possible quantity of butter without taking on too much fat.

The following are **balanced daily rations** for a cow that will average 3 gal. of milk per day:

I. 15 lb. alfalfa hay
4.5 lb. corn (chops or meal)
6 lb. molasses

II. 20 lb. cotton-seed hulls
7 lb. corn (chops or meal)
4 lb. cotton-seed meal

III. 10 lb. timothy hay
14 lb. bran (wheat)
4 lb. molasses

IV. 27 lb. Lespedeza hay
4.5 lb. oats
7.5 lb. corn (chops or meal)

There are other combinations that will do about as well as these. But for economy and good results nothing will suit better in the South than a ration that includes cotton-seed meal and hulls.

The average prices of feeds per pound are about as follows:

Cotton-seed meal	1¼¢	Alfalfa hay	⅘¢
Corn chops or meal	1¾¢	Hulls (cotton seed)	⅖¢
Molasses	½¢	Pea-vine hay	½¢
Oats	2¢	Lespedeza hay	⅗¢
Bran (wheat)	1¾¢	Timothy hay	1¼¢

Butter fat is the best and richest part of milk. It is that from which butter is made.

A 4 per cent milk, which is often written 4% milk, contains 4 lb. of butter fat for every 100 lb. of milk.

Butter is about 80% fat; that is, in 100 lb. butter there are 80 lb. of butter fat.

Milk is about 4% fat, and cream from 15% to 40% fat.

Milk or cream weighs 8.6 lb. per gallon.

In the following problems the prices of feeds as given above are to be used.

1. What would be the cost of feeding a cow through the winter months, say 180 days, on full ration, and 180 days on half ration, using ration I?

2. What would be the cost with ration II? ration IV?

3. Estimating the labor at $26, what would be the total cost of keeping a cow on ration III according to conditions named in example 1?

4. Estimating labor at $26 a year, find the cost of keeping a cow a year on ration II.

5. If this cow gives 3 gal. of milk per day for 300 days, 4% butter fat, how many pounds of butter will she produce in a year? (Count 1¼ lb. of butter to 1 lb. butter fat.)

6. Supposing butter worth 25 cents per pound and 720 gal. skim milk (from separator) worth 5 cents per gallon for hog feed, what will be the receipts from this cow for the year?

7. Would it pay to keep a cow that gives only 2 gal. of 3% milk a day, using ration I, supposing that the skim milk will just pay for the labor (not counting value of fertilizer), if butter sells at 25 cents per pound?

8. At present prices of hulls, cotton-seed meal, and corn, in your community, what profit would there be in keeping a cow that gives 300 lb. of butter per year, the skim milk paying cost of labor, counting butter at present price, retail?

9. If butter is worth 30 cents a pound, how many pounds must a cow give per year to make a profit of $25, supposing her feed to cost $50 and pasturage $6, no allowance being made for labor, value of skim milk, and fertilizer?

10. How many gallons of milk would this cow have to give per day, supposing her milk to test 4% butter fat?

11. Mr. G.'s poorest cow made 212 lb. of butter during 1908. At a cost of $10 more his best cow yielded 503 lb. How much more profit did he receive from the good cow than from the other, butter being worth 26¢ per pound?

COST OF CULTIVATING AND HARVESTING

The following estimates are tentative; if practical, the pupil should substitute for them such as prevail in his locality.

Estimate labor at $1 per day; single team, $1; double team, $1.75; man, single team, and plow, $2; man, double team, and plow, $3; man, team, and wagon, $3.50; mower, team, and driver, $5; average cost of hauling cotton and cotton seed to market, 27 cents per ton per mile; hauling baled hay, 19 cents per ton per mile; cost of having cotton "picked," 60 to 75 cents per hundred pounds seed cotton.

1. A certain field is 275 yd. by 352 yd. How many acres are there in it?

2. How many days will it take to plow it at 2 A. per day for man and double team? How much will it cost?

3. If a man and single team can harrow 10 A. per day, how much will it cost to have above field of 20 A. harrowed?

4. A man and single team can plant 6 A. per day and cultivate 4 A. per day (two furrows to row with cultivator or other plow). How much will it cost to have the field planted and then cultivated three times?

5. The hoeing would probably require a man one half day to each acre. How much would this cost for the 20 A.?

6. If this field produces 20 bu. of corn to the acre, how much will it cost to have it gathered if a man can "pull" 100 bu. per day and it takes two men and a wagon to haul what one man pulls?

7. A farmer plants a field of 13 A. in peas for forage. The seed costs $2 per bushel and it takes 2 bu. to plant an acre. If plowing, harrowing, and planting require 10 days' labor at $2.75 a day, what will be the total cost for seed and labor?

8. It requires 2 days at $5 a day to mow the field and takes two men and wagon 1½ days to haul in the hay. How much will this cost?

9. The yield is 3 tons per acre and the current price is $12 per ton. How much does the farmer make on this crop?

10. An alfalfa field costs $10 an acre to prepare and seed. It yields four cuttings of one ton per acre each cutting. The cost of harvesting is $12 per acre. How much does the farmer make clear, on 18 A. of this field, if the hay sells for $16 per ton?

11. A farmer plants 10 A. in cotton, having the land plowed twice (2 A. per day for each plowing with a man, double team, and plow) and harrowed once (10 A. per day with a single team) before planting. It takes a man and single team 1½ days to plant it, and requires 8 bu. of seed that cost $1 per bushel. The "scraping" and "chopping" cost, together, $1 per acre. It takes three men and single teams 1½ days to cultivate it one time; there are four cultivations. Find total cost of these items.

12. The field yields 900 lb. of seed cotton per acre. How much does it cost to have it picked, at 60 cents per 100?

13. The bagging and ties cost $1.20 per bale and the ginning $1.75 per bale. The hauling costs $13 for the seed and cotton. If the cotton sells for 13 cents per pound and the seed for $22 per ton, what amount will the farmer have left after paying all expenses? How much will this be per acre? (See p. 212.)

14. If the boll weevil had reduced the yield to 300 lb. of seed cotton per acre, what would have been the net profit or loss on the crop? (Remember that this would lessen the cost of picking, etc., as well as the gross receipts from sale of seed and cotton.)

SEEDS

The following table gives the weights of certain seeds per bushel, and approximately the amounts necessary to plant an acre, and the periods of germination:

	Weight per Bu.	Amount per Acre	Time to Germinate
Alfalfa clover	60 lb.	30 lb.	25–35 da.
Alsike clover	60 “	15 “	25–35 “
Barley	48 “	90 “	12–20 “
Beans	60 “	60 “	5–10 “
Broomcorn	46 “	10 “	10–15 “
Buckwheat	48 “	48 “	10–20 “
Castor beans	46 “	10 “	....
Clover, Japan	25 “	25 “	30–40 “
Clover, red	60 “	15 “	25–35 “
Clover, white	60 “	6 “	25–35 “
Corn, on ear (shucked)	70 “	....	....
Corn, shelled, Adams	50 “	12 “	8–14 “
Corn, shelled, field	56 “	10 “	8–14 “
Cotton	30 “	25 “	....
Flaxseed	56 “	30 “	....
Grass seed, mixed lawn	....	3 bu.	12–15 “
Grass seed, orchard	14 “	28 lb.	8–15 “
Grass seed, Kentucky Blue	14 “	28 “	14–21 “
Grass seed, timothy	45 “	12 “	15–25 “
Hemp seed	44 “	22 “	....
Kaffir corn	56 “	20 “	10–15 “
Lettuce, 1 oz. to 250 feet of drill . .	....	3 “	6–10 “
Melon, musk, 1 oz. to 100 hills . . .	....	28 oz.	5–10 “
Melon, water, 1 oz. to 25 hills . . .	....	24 “	8–15 “
Millet, German and Italian	50 “	30 lb.	8–15 “
Mustard	58 “	....	3–7 “
Oats	32 “	60 “	12–20 “
Onions	54 “	4 “	7–10 “

SEEDS — *Continued*

	Weight per Bu.	Amount per Acre	Time to Germinate
Onion sets	32 lb.	10 bu.	....
Peas, English, smooth	60 "	90 lb.	5–10 da.
Peas, English, wrinkled	56 "	84 "	5–10 "
Peas, field	60 "	2 bu.	5–10 "
Potatoes, Irish	60 "	10 "	....
Potatoes, sweet	60 "	....	....
Radish, 1 oz. to 150 feet of drill	50 "	8 lb.	3–5 "
Rape	50 "	7 "	....
Rye	56 "	90 "	12–20 "
Sorghum	50 "	20 "	10–15 "
Sugar cane (stalks)	....	4 tons	....
Sunflower, Russian	24 "	....	5–10 "
Tomato, 1 oz. to 3000 plants	....	4 oz.	5–15 "
Turnip, 1 oz. to 260 feet of drill	58 "	24 "	5–7 "
Vetch	60 "	90 lb.	15–20 "
Wheat	60 "	90 "	12–20 "

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